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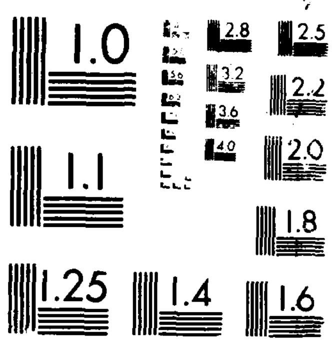
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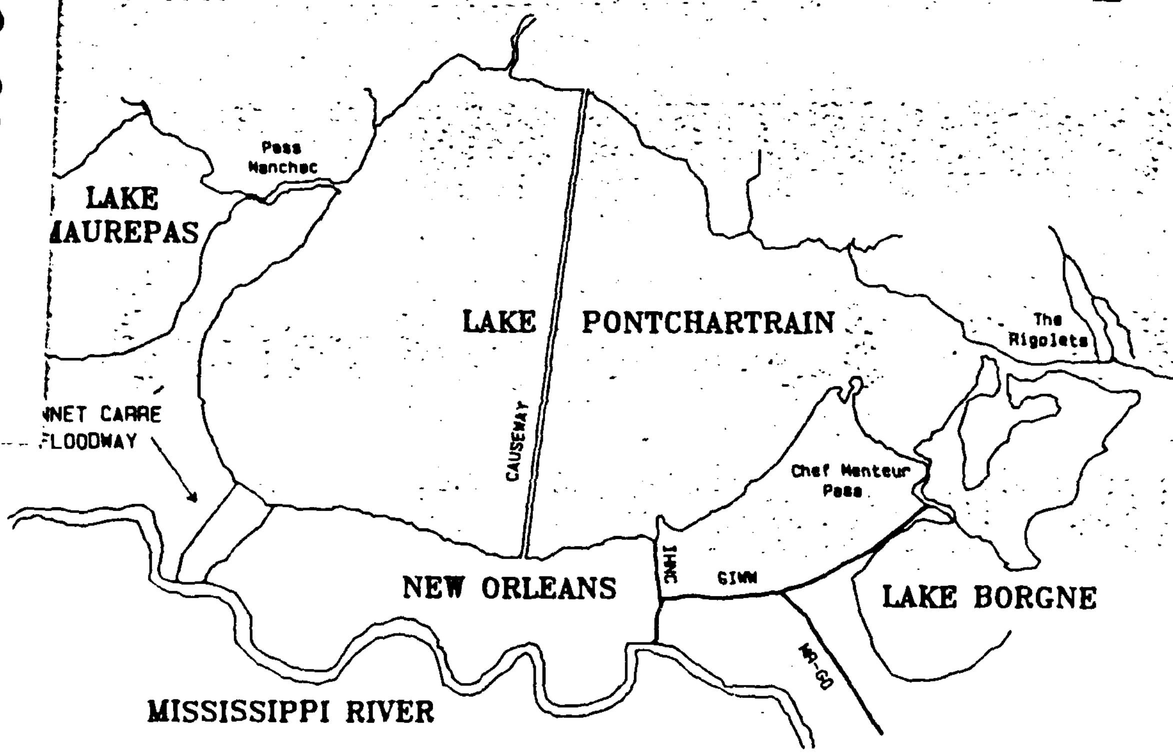
US Army Corps
of Engineers
New Orleans District

CLAM SHELL DREDGING IN LAKES PONTCHARTRAIN AND MAUREPAS, LOUISIANA



Volume 3

Responses to Public Comments

November 1987

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REPORT DOCUMENTATION PAGE

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9. PERFORMING ORGANIZATION NAME AND ADDRESS Department of the Army, New Orleans District Corps of Engineers, P.O. Box 60267 New Orleans, Louisiana 70160-0267		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
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Approved for Public Release, Distribution is Unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

Same

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Alternatives	Endangered Species	Shell Dredging
Benthos	Fisheries	Social Impacts
Contaminants	Grassbeds	Turbidity
Cultural Resources	Lake Pontchartrain	Water Quality
Economic Environment	Sediments	Wildlife

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Clam shells (Rangia) have been harvested from Lakes Pontcahrtrain and Maurepas since 1933 by means of hydraulic dredges. The shells are used primarily in construction activities, but have a variety of other uses as well. There has been considerable controversy over the environmental impacts of shell dredging. This Final Environmental Impact Statement assesses the impacts of shell dredging in the lakes as permitted under 5-year permits issued in 1982 that will expire in December 1987. The document also addresses the impacts of applications for 10-year permit extensions that would allow shell (over)

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VOLUME 3

RESPONSES TO PUBLIC COMMENTS

This volume contains responses to the comment letters on the Draft Environmental Impact Statement received from Federal and state agencies and other interested parties. Copies of the comment letters are provided in Volume 2. The letters contained in Volume 2 are bracketed into specific comments. This volume provides responses to each specific comment provided in Volume 2. The comments and responses are contained in separate volumes so they can be viewed side-by-side for ease of the reviewing public.

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Federal Agencies

State Agencies

Others

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RESPONSE A.1.1: Comment noted.

RESPONSE A.2.1: Comment noted.

RESPONSE A.3.1: Concerns expressed in this general comment are addressed below in responses to specific comments.

RESPONSE A.3.2: Concerns expressed in this general comment are addressed below in responses to specific comments.

RESPONSE A.3.3: A statement has been added on page S-6 to acknowledge that shell dredging may have contributed to long-term turbidity increases in the lake. The fact that the extent of contribution of shell dredging to the apparent long-term turbidity increase in Lake Pontchartrain is unknown, combined with the many other factors that have also been implicated in the turbidity increase, do not allow formulation of the conclusion that shell dredging has caused long-term, chronic turbidity problems. The issue of turbidity has been discussed at length in the EIS and appendixes.

RESPONSE A.3.4: A sentence has been added on page EIS-3 to address the area affected by sediment deposition.

RESPONSE A.3.5: As noted in Table 1 in Section 2 of the FEIS, lightweight material is sometimes needed (depending on the bearing capacity of the foundation) for base courses, dike cores, dolphin fill, pervious backfill, and subbases.

The use of a substitute material would be at a higher cost and could result in marginal projects being abandoned. Information provided by the Louisiana Department of Transportation and Development indicates that for some applications shell is superior to any possible alternative material.

General percentages of shell used are as follows:

80% - General construction and maintenance (Base course, parking lots, levees, drill pads, etc.)

10% - Acid neutralization, smoke stack emission control, chemicals, and pharmaceuticals

5% - Lime

5% - Oyster reef cultch

RESPONSE A.3.6: Closure of Lake Maurepas does not have to be carried as a separate alternative in order for the Corps to consider cessation of shell dredging in that lake. The existing permits and the permits for which extensions are being requested are for both Lakes Maurepas and Pontchartrain. The Corps can restrict shell dredging in any portion of this area as a condition of the permits. Information contained in the FEIS will play a major role in the public interest review that will be accomplished prior to making decisions on areas to be permitted or denied.

RESPONSE A.3.7: See revised Section 2.2.3.2 in the FEIS.

RESPONSE A.3.8: The discussion has been expanded to incorporate your comment (see pages 21 and 22 of the FEIS).

RESPONSE A.3.9: The brief characterization of lake bathymetry that appears on page 36 of the DEIS and again on page C-50 is considered sufficient since there is little variability except in the eastern end of the lake, which is acknowledged to be deeper. Information addressing the remainder of this comment has been added to pages C-94 and C-95 of the FEIS.

RESPONSE A.3.10: The DEIS acknowledges that shell dredging contributes to the long-term increase in overall lakewide turbidity, but the extent of its contribution is unknown. In order to comply with the requirements in 40 CFR Part 1502.22, particularly sections (b)(1), (b)(2), (b)(3), and (b)(4), additional information regarding long-term turbidity and its potential impacts has been added to Section 3.4.2.3.2 of the FEIS (see pages EIS 60-62).

RESPONSE A.3.11: The text on page 46 of the FEIS has been modified. Subsequent review of contaminant data indicate that, except near the outfall canals, sediments in Lake Pontchartrain are not heavily contaminated.

RESPONSE A.3.12: This paragraph has been modified to incorporate your concerns (see page 57 of the FEIS).

RESPONSE A.3.13: See response A.3.10.

RESPONSE A.3.14: See response A.3.10.

RESPONSE A.3.15: New information regarding the fluid mud layer created by shell dredging has been developed since distribution of the DEIS. See pages EIS-53-54 and C-74-76 of the FEIS. With regard to potential impacts of this fluid mud layer on Rangia, see page 77 of the FEIS.

RESPONSE A.3.16: Information has been added to page 79 of the FEIS to acknowledge that the importance of large, live Rangia is not limited to their direct food value.

RESPONSE A.3.17: It is acknowledged that systems with high species diversity and low faunal abundance are considered in theory to be "healthier" and more stable than systems having lower diversity and high abundance. Information in the EIS portrays Lake Pontchartrain as a perturbed system due to a variety of factors. Several investigators have estimated that the species diversity in the lake in the past was higher than it is today. Although we will never know for sure, it is reasonable to assume that it was. However, the purpose of this EIS is to assess the impacts of shell dredging on the system under existing and future conditions. The fact that diversity may have been higher in the past is not an issue of primary importance. The important issue is whether or not diversity in Lake Pontchartain would revert to past levels over the next 17 years (estimated life of the industry) if shell dredging were terminated. With the many perturbations that affect the lake other than

shell dredging, this is highly unlikely. It should be pointed out that Lake Pontchartrain is and was in the past a dynamic estuarine system and was probably never characterized by the high species diversities found in more stable freshwater and marine environments. Darnell (1962) pointed out that severe and often sudden variations occur in the physical environment of Lake Pontchartain, and although some fluctuation in population levels is probably characteristic of northern Gulf-coastal communities in water of all degrees of salinity, within such shallow brackish areas as Lake Pontchartrain population instability must approach a maximum.

RESPONSE A.3.18: See response A.3.10 and refer to the information that has been added to Section 3.4.2.3.2 of the EIS.

Response A.3.19: The fact that Lakes Maurepas and Pontchartrain serve as a nursery area for fishery resources that are ultimately harvested offshore has been acknowledged on page 84 and in other areas of the FEIS, as well as in other responses to comments.

RESPONSE A.3.20: Guillory (1982) reported the differences in trawl catches in terms of catch per unit effort and did not report whether or not they were statistically significant.

RESPONSE A.3.21: Reference our response to comment A.3.16.

RESPONSE A.3.22: Contrary to the position you have presented in the first sentence of comment A.3.22, information contained in the DEIS does not allow formulation of the conclusion that shell dredging has adversely impacted marine fishery resources. However, it is true that the level of impact is uncertain. In response to your comment A.3.10, information has been added pursuant to 40 CFR 1502.22. In that information, it was acknowledged that long-term turbidity increases, to which shell dredging may contribute, might adversely impact the productivity of grassbeds, phytoplankton, and benthos. In response to this particular comment, it is acknowledged that these impacts may adversely impact fishery

populations. With regard to CFR 40 Part 1502.22(d), we have addressed the probable impacts using information available in the literature, a practice that is commonly used and generally accepted by the scientific community. The degree of impact has also been evaluated using other evidence, i.e., no crash in fisheries, no dredge-related fish kills, and continued commercial and recreational fishing.

RESPONSE A.3.23: Although the specific concerns of this report are the environmental, economic, and social impacts of clamshell dredging in Lakes Pontchartrain and Maurepas, information has been added to this paragraph to address recent trends in shell harvest in adjacent Gulf states (see pages 97 and 100 of the FEIS).

RESPONSE A.3.24: The term "unadjusted price levels" as used in this report refers to price levels unadjusted for the effects of inflation. The referenced paragraph has been revised to so indicate (see page 102 of the FEIS). The report has also been revised to indicate that the harvest of commercial fishery resources has a "multiplier" effect on the local economy similar to shell dredging (see page 105 of the FEIS).

RESPONSE A.3.25: The figures for both catch and landings are reported to show the continued productivity of the area within the lakes and adjacent Gulf waters. It is acknowledged that Lakes Maurepas and Pontchartrain serve as a nursery area for fishery resources that are ultimately harvested offshore; however, with the available information it is not possible to determine what portion of the catch in this larger area is dependent upon Lakes Pontchartrain and Maurepas.

RESPONSE A.3.26: It has been reported by Roberts and Thompson (1982) that the blue crab catch in Lake Pontchartrain may be six times greater than reported in NMFS stastistics. Studies have not been conducted to document under-reporting for other species caught in the lake; however, a discussion has been added to page 105 of the FEIS regarding estimates of under-reporting for other species on a state-wide basis. It is

acknowledged that the lake provides nursery habitat for a variety of estuarine-dependent species. See also Response A.3.19.

RESPONSE A.3.27: Information regarding the impact of Bonnet Carre' Spillway operation on Rangia distribution has been added to page 146 of the FEIS.

RESPONSE A.3.28: Changes to this section have been made to acknowledge that some of these permitted activities cause long-term impacts (see page 149 of the FEIS).

RESPONSE A.3.29: Information regarding bulk density in the selected lakes and the seven stations in Lake Pontchartrain has been added to page D-22 of the FEIS.

RESPONSE A.3.30: Information has been added regarding sediment characteristics in laboratory tanks as compared to natural lake bottom (see page D-26 of the FEIS).

RESPONSE A.3.31: Requested data has been added (see page D-25 of the FEIS).

RESPONSE A.3.32: The fact that the shallow burial test lasted one week is clearly stated on page D-24.

RESPONSE A.4.1: Comment noted.

RESPONSE A.4.2: Comment noted.

RESPONSE A.5.1: The zoning restrictions referred to in section 2.2.3.1 of the alternatives section were the 10 zones established by the Louisiana Department of Wildlife and Fisheries primarily to reduce user conflicts between shell dredgers and fishermen (Figure 5). Closure of Lake Maurepas does not have to be carried as a separate alternative in order for the Corps to consider cessation of shell dredging in that lake. The existing permits and the permits for which extensions are being requested are for both Lakes Maurepas and Pontchartrain. The Corps can restrict shell dredging in any portion of this area as a condition of the permits. Information contained in the FEIS will play a major role in the public interest review that will be accomplished prior to making decisions on areas to be permitted or denied.

RESPONSE A.6.1: Comments noted.

RESPONSE A.6.2: Reference 33 CFR Part 230, Appendix B, Environmental Operating Procedures and Documents for Regulatory Functions, (11)(7)(c) - "Except for Federal projects meeting the requirements of Section 404(r) of the Clean Water Act, the Section 404(b)(1) analysis under the Clean Water Act may, but need not necessarily, be included in the EIS at the discretion of the district engineer. The information required by the 404(b)(1) guidelines, when included, will be integrated into the text of the EIS."

Compliance with the guidelines is a separate determination required under the 404 permit program - not a statutory or regulatory part of the NEPA process. The guidelines evaluation is not included within the definition of "Environmental Document" for NEPA purposes in the CEQ regulations (40 CFR 1508.10). Rather, the CEQ regulations and Corps regulations implementing NEPA provide that compliance with Section 404 shall be discussed in the "Record of Decision" (40 CFR 1505.2, 33 CFR 325.2(a)(6) and 33 CFR 230.12) - a decision document distinct from the environmental impact statement. The guidelines evaluation is undertaken as part of the Corps' public interest review in deciding whether or not to issue the permit (33 CFR 325.2(a)(6).

The 404(b)(1) guidelines themselves distinguish between EIS preparation and the determination of guidelines compliance. (40 CFR 230.10(a)(4). Although NEPA documents may provide information that can be used in the guidelines, the two procedures are not the same. There is no requirement that the guidelines evaluation be ıcluded as part of the EIS process.

RESPONSE A.6.3: This comment is incorrect. Section 1502.14(b) of the Council on Environmental Quality's National Environmental Policy Act Regulations requires that substantial treatment be given to each alternative considered in detail. The EIS afforded substantial treatment to each of the alternatives considered in detail.

RESPONSE A.6.4: Closure of Lake Maurepas does not have to be carried as a separate alternative in order for the Corps to consider cessation of shell dredging in that lake. The existing permits and the permits for which extensions are being requested are for both Lakes Maurepas and Pontchartrain. The Corps can restrict shell dredging in any portion of this area as a condition of the permits. Information contained in the FEIS will play a major role in the public interest review that will be accomplished prior to making decisions on areas to be permitted or denied.

RESPONSE A.6.5: Several comments have been received regarding the analysis of alternative materials in the EIS. Additional information and explanation has been added to this section to provide a more thorough and understandable analysis.

RESPONSE A.6.6: Reference 33 CFR Part 230, Appendix B, Environmental Operating Procedures and Documents for Regulatory Functions, 11 (b)(5)(d) - "For regulatory permit actions, the Corps takes an impartial position whether to issue or deny a particular application until the public interest review is complete. At no time is the Corps a proponent of any action. It simply determines whether or not certain actions proposed by applicants are in the public interest and under what circumstances such proposals, if modified, would be in the public interest. The Corps' decision that is made by the final decision maker will be stated in the Record of Decision."

RESPONSE A.6.7: The numerous regulations and restrictions that have been imposed upon the shell dredgers by the Corps, Louisiana Department of Wildlife and Fisheries (LDWF), Louisiana Department of Natural Resources (DNR), and Louisiana Department of Environmental Quality (DEQ) have been considered by these agencies to be appropriate mitigation measures. In addition, as part of the DNR permits, as compensation for disturbance of water bottoms during dredging, the permittee shall at its expense undertake offsite restoration by constructing reefs when recommended by

the Secretary of LDWF in the lakes area. No such restoration has ever been recommended by LDWF. If, during the public interest review, further mitigation needs are identified, they will be incorporated as a condition of the Corps' permit.

RESPONSE A.6.8: In the case of clam shell dredging in the lakes, there has been considerable coordination among state and Federal agencies, shell dredging companies, and fishermen. As pointed out in the EIS and Appendixes, the activity is regulated by the Corps, LDWF, DNR, and DEQ. Many regulations and restrictions have been imposed upon the shell dredgers. The zones and schedules for dredging in the various zones imposed on an annual basis by the LDWF were established primarily to reduce user conflicts with commercial and recreational fishermen.

RESPONSE B.1.1: It has been determined that shell dredging activities will not be managed under the New Orleans District Underwater Cultural Resources Management Plan. However, data generated during development of the Underwater Cultural Resources Management Plan will be used as a reference tool. Any Department of the Army Permits, if issued or extended, would contain special and general conditions requiring the permittee to notify the Corps if any previously unknown historic or archeological remains are discovered while accomplishing the activity authorized by the permit. The Corps would then initiate the Federal and state coordination required by 33 CFR Part 325, Processing of Department of the Army Permits; Procedures for the Protection of Cultural Resources.

RESPONSE B.2.1: Comment noted.

RESPONSE B.2.2: Your Department has established 9 zones in Lake Pontchartrain (Zones 1-8 and A, Figure 5 in the EIS). Dredging is allowed in only three zones at any given time. The primary purpose of the zoning is to reduce user conflicts between the shell dredgers and commercial and recreational fishermen. The schedule for dredging in these zones is established annually by your Department. Since the areal extent of the zones varies and the schedule does not remain the same on an annual basis, the percentage of area available for dredging at any given time also varies. The schedule for 1987 is shown in Response C.1.24. Approximate percentages for each of the zones in relation to the areal extent of the permitted area are shown below.

Zone A - 5%	Zone 5 - 11%
Zone 1 - 2%	Zone 6 - 13%
Zone 2 - 9%	Zone 7 - 20%
Zone 3 - 8%	Zone 8 - 19%
Zone 4 - 13%	

Based on the 1987 schedule and the areas of the various zones, the area open for dredging ranges from about 25% of the permitted area in February to about 42% of the permitted area in March. On a year around basis, an average of 33% of the permitted area is open to dredging in any given month. Since about 44% of the total 630 square-mile lake area is open to dredging, the percentage of the total lake area affected by dredging in any given month is about 15%.

RESPONSE B.2.3: Comment noted.

RESPONSE B.3.1: Comment noted.

RESPONSE B.3.2: Comment noted.

RESPONSE B.4.1: Comments noted.

RESPONSE B.4.2: Comments noted.

RESPONSE B.4.3: The EIS was not limited to two alternatives, rather only two alternatives were considered in detail. During the scoping process, several generic alternatives were identified for consideration. Based on that guidance, a variety of specific alternatives were developed. Only after a thorough analysis of these specific alternatives was it determined that renewing the permits with existing conditions and no Federal action (permit denial) should be investigated in further detail in the EIS. NEPA does not specify the number of alternatives that should be retained for detailed consideration.

As stated in the introduction to the alternatives section of the EIS, shell dredging has taken place in the lakes since 1933 and, over the years, many regulations and restrictions (which are in effect alternatives) have been imposed upon the activity by a variety of interested parties. These affected the scope of alternatives addressed in the EIS. It would have been foolish to approach shell dredging in a vacuum and ignore the considerable efforts of many in the past to ameliorate the impacts of the activity.

It should also be pointed out that the two alternatives retained for detailed consideration do not represent an "all or nothing" dichotomy. Under Alternative 1 "Renew Permits with Existing Conditions," any conditions deemed necessary as a result of information presented in the EIS or as a result of the public interest review can be added to the permits before they are reissued (if they are reissued) or at any time during the life of the permits.

RESPONSE B.4.4: The discussion of the impacts on the industry of reduced intensity is entirely appropriate. The purpose of the cited section is to assess the anticipated impacts of this alternative on a variety of

socio-economic variables based on accepted principles of economic behavior, just as environmental impacts are based largely on expected outcomes as opposed to post factum observation. In fact, much of the data used in the analysis was provided by the industry, as is clearly stated in the document, and thus ought to reflect in general terms the industry response to the alternative. As the discussion points out, under certain assumptions a mandated reduction in intensity carries fewer adverse impacts than complete cessation, while under other assumptions reduced intensity is tantamount to cessation. What the discussion also points out is that virtually no measurable beneficial output would be realized from imposition of this alternative, while substantial harm would result. For this reason the alternative was judged to be unreasonable and was dropped from further consideration.

RESPONSE B.4.5: Section 102, paragraph (2)(a) of NEPA, 40 CFR 1508.8, Public Law 91-611, and implementing COE regulations, require that an EIS discuss and consider the impacts of proposed actions on a broad range of socio-economic parameters which largely define and affect the quality of the human environment.

RESPONSE B.4.6: Modifications to discharge pipes on a dredge by dredge basis to reduce localized turbidity do not constitute "alternatives" of the magnitude normally considered in an EIS. Although it is acknowledged that modifications can and have been made to somewhat reduce localized turbidity, high levels of short-term, localized turbidity will always accompany shell dredging activities. However, as borne out by impact discussions in the EIS, the impacts resulting from this short-term, localized turbidity are not of great biological consequence.

RESPONSE B.4.7: In preparing the EIS, the Corps took advantage of the large amount of published information available regarding historical and existing conditions in the study area and the impacts of shell dredging on the resources of the study area. The Corps believes the available information is adequate to permit informed decision making.

The Sikora's study investigated benthic populations at an experimental station dredged by a shell dredge (DX) and an experimental control station (DC). It was designed to provide information on impacts to benthos directly related to shell dredging activities. Since impacts to benthos and rate of recovery of benthic populations is one of the primary areas of concern in relation to shell dredging, we wanted to assess benthic recovery over a longer period of time than assessed in the Sikora study, which lasted about two years. Our primary purpose in resampling the Sikora's stations was to gather information regarding the status of benthic communities at the two stations on a more long-term basis.

The Sikoras were aware that this study was being conducted and provided Dr. Stephen A. Bloom with data from their study.

RESPONSE B.4.8: The categorization of alternatives is based on guidance presented in Corps regulations ER 200-2-2, Appendix B, Environmental Operating Procedures and Documents for Regulatory Functions. We have expanded this discussion in hopes that it may be clearer to the reviewers.

RESPONSE B.4.9: Section 2.2.1.1 has been revised to present a more reasoned discussion of alternative materials. Although the new information does not provide an exhaustive discussion of alternative materials, we feel it is adequate and puts the issue of alternative materials in perspective from both an engineering and economic standpoint.

RESPONSE B.4.10: The Corps did consider Judge McNamara's suggestions very seriously. In preparing the EIS, a vast amount of published information has been utilized, much of which has become available just in the last few years. In addition, certain new information has been gathered. The Corps believes the information presented in the EIS is adequate to permit informed decision making and fully embraces the intent of Judge McNamara's language.

RESPONSE B.5.1: Comments noted.

RESPONSE B.5.2: Comments noted.

RESPONSE B.5.3: Comment noted.

RESPONSE B.5.4: We concur that it is the responsibility of the Corps to assure there is enough data to permit informed decision making and it is our position that adequate information is available. It is acknowledged that certain data that would be nice to have are not available. However, this data is either exhorbitantly exspensive to obtain or beyond the state-of-the-art and in either case is not essential to informed decision-making.

RESPONSE B.5.5: It is true that there are time periods not influenced by Bonnet Carre' waters when the lake has low salinity. The EIS clearly states that salinities range from fresh to brackish and presents historic data at several stations in the study area. Most of the data presented by Thompson and Fitzhugh (1985) shows salinity $\geq$1.0 ppt, which is sufficient to cause some flocculation. Additional data has been presented in Appendix C, which shows the percent of time salinity levels are $<$1.0 ppt.

RESPONSE B.5.6: The EIS acknowledges that shell dredging alters benthic habitat and impacts benthic organisms with little or no ability to move. The organisms referred to in this statement are highly motile organisms such as juvenile and adult fishes, crabs, and penaeid shrimp. These organisms are generally able to avoid areas of excessive turbidities that occur in the vicinity of the dredge; however, it is acknowledged that certain larval stages of these organisms may not be able to escape. Although it is true that man does not know what constitutes "excessive turbidities" for many species, the organisms themselves can detect such areas and avoid them. It should be emphasized that the shallow estuaries of coastal Louisiana, including Lake Pontchartrain, have been

characterized by high turbidities due to Mississippi River inflows and winds for thousands of years and the organisms that inhabit these estuaries have to be tolerant of these conditions in order to survive.

RESPONSE B.5.7: The discussion in Appendix C (page C-79 of the DEIS and pages C-92 and C-93 of the FEIS) discusses the relative degrees of bottom disturbance of shrimp trawling and shell dredging, and concludes that the upper water column turbidity generated by trawling is significantly less than by dredging. See also Response C.1.13.

RESPONSE B.5.8: The first part of the comment (observed Secchi depths much greater than five feet) is acknowledged. The second part of the comment, however, does not accurately convey Thompson and Fitzhugh's findings. They reported that maximum Secchi depths during 1978 (not present day) were similar to yearly averages from the 1950's.

RESPONSE B.5.9: Comment noted. Much of the information he collected in those early studies was used by the Corps in preparing the EIS.

RESPONSE B.5.10: Comment noted. See also Response B.5.9.

RESPONSE B.5.11: In this comment, as well as in comments B.5.12 through B.5.15, Dr. Darnell has noted certain changes that have taken place since his studies in the early 1950's. Dr. Darnell conducted a one-day survey of Lake Pontchartrain on June 19, 1987, during which he made some visual observations of bottom samples and associated biota. Based on this one-day sampling trip, he made some general statements comparing the condition of the lake in 1953-54 and 1987.

Dr. Darnell noted that the surface sediments are no longer firm except in nearshore areas and that dead Rangia shells and shell hash (shell fragments) were not as abundant as in the 1950's. This would be expected since shell dredges have harvested most of the dead Rangia shells. In addition, the screening process that takes place on the

dredges retains shell fragments larger than three-eighths of an inch. Extraction of this shell material from the sediments could cause the substrate to be less firm. Dr. Darnell also noted that organic detritus, recognizable as bits of decomposing Spartina, is much less abundant than in his earlier studies. This is not surprising, since many thousands of acres of wetlands surrounding the lake have been developed since the early 1950's. Wetlands are one of the primary sources of organic detritus.

RESPONSE B.5.12: Dr. Darnell's recent observations regarding the bottom molluscan fauna basically agree with the findings of other recent benthic studies conducted in the 1970's and 1980's. These studies have been reviewed in the EIS and appendixes. Adult and sub-adult Rangia are more abundant in nearshore areas and along the Causeway, but are generally absent throughout the open lake. However, Dr. Darnell reported that the two small gastropods that were formerly widespread were found in abundance only near the south shore. This is in disagreement with other recent benthic studies which showed high numbers of the two small gastropods widely distributed in the lake.

RESPONSE B.5.13: The concept that the softer sediments in the open lake cannot support the weight of adult and subadult Rangia is not new and was discussed in the EIS and appendixes. Another likely reason for the absence of large Rangia in much of Lake Pontchartrain is that shell dredging disturbs the benthic habitat with sufficient frequency to preclude establishment of widespread populations of large Rangia, although a combination of factors may be involved. In any event, the large Rangia are not there and it is clear that shell dredging has played a major role in their demise. This is clearly acknowledged in the Corps' documents.

It is acknowledged that the decline in abundance of large Rangia has resulted in a dramatic decline in molluscan biomass in the lake and therefore a reduction in the total available food supply for certain organisms. However, most fishes and invertebrates feed on small Rangia

and other small benthic organisms, which are still abundant in the lake, even in areas where dredging is permitted. Only a few species such as black drum, sheepshead, and blue crabs consume large Rangia in any quantity.

RESPONSE B.5.14: It is acknowledged that shell dredging has essentially eliminated the dominant populations of adult Rangia, fossil shells, and shell hash in those portions of the lake where dredging is permitted. See response B.5.13.

RESPONSE B.5.15: The statement has been modified to address Dr. Darnell's concerns.

RESPONSE C.1.1: Comment noted.

RESPONSE C.1.2: Comment noted.

RESPONSE C.1.3: Comment noted.

RESPONSE C.1.4: The U.S. Environmental Protection Agency (EPA) treats shell, sand, and gravel dredging as it does maintenance dredging operations, i.e., if the activity is conducted under a Section 404 permit, then it is exempt from 402 discharge permit requirements. The shell dredging industry has official correspondence from EPA confirming that an NPDES permit is not required.

With regard to the wastewater discharge permits to be required by DEQ, see Response C.2.25.

RESPONSE C.1.5: Although the 404(b)(1) analysis is generally included in draft EIS's for Corps civil works projects, this is normally not the case with regulatory EIS's, and there is no legal requirement that a 404(b)(1) analysis be included. See the response to comment A.6.2.

RESPONSE C.1.6: As stated in response C.1.5, there is no legal requirement that a 404(b)(1) analysis be included in an EIS for regulatory activities. Further, 40 CFR sections 230.10 and 230.11 do not identify the EIS as the only source of information to determine compliance. Although NEPA documents may provide information that can be used in the guidelines evaluation, the two procedures are not the same.

RESPONSE C.1.7: The reason the discussion regarding Lake Maurepas is less than for Lake Pontchartrain is because fewer studies have been conducted and less information is available for that lake. However, we feel that the available information regarding the impacts of shell dredging in Lake Maurepas is sufficient to make an informed decision whether or not to permit shell dredging in that lake.

Closure of Lake Maurepas does not have to be carried as a separate alternative in order for the Corps to consider cessation of shell dredging in that lake. The existing permits and the permits for which extensions are being requested are for both Lakes Maurepas and Pontchartrain. The Corps can restrict shell dredging in any portion of this area as a condition of the permits. Information contained in the FEIS will play a major role in the public interest review that will be accomplished prior to making decisions on areas to be permitted or denied.

RESPONSE C.1.8: As required by the Endangered Species Act, the Corps coordinated with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service regarding potential impacts to endangered species as a result of shell dredging. These agencies have jurisdiction over endangered species and are the acknowledged experts regarding these species. Based on correspondence with these agencies, the only endangered or threatened species they considered potentially impacted by shell dredging in the lakes area are the Atlantic ridley and loggerhead sea turtles. Although there have been manatee sighting(s) in Lake Pontchartrain, the potential for impacts to manatees as a result of shell dredging is insignificant.

RESPONSE C.1.9: Comment noted.

RESPONSE C.1.10: Information has been added to Section 3.4.2.3.1 (page 50) of the FEIS to address your concerns regarding background turbidity.

There are several references in the EIS and appendixes of ambient and dredge-induced turbidity levels measured during dredging operations which indicate the variability of turbidity under different conditions. The referenced statement on page 41 of the DEIS should be understood as a general representation of what might reasonably occur on the average, not as a prediction of what would happen in a particular case.

RESPONSE C.1.11: Mean monthly salinity levels at the Pass Manchac station in Lake Pontchartrain are 1.0 ppt or less from January through August, with an averaqe of 0.8 ppt during the eight-month period. As can be seen in Table C-1, mean salinity levels of 1.0 or less have persisted at this station for as many a 40 consecutive months, and for 58 of 59 consecutive months during the period 1957 to 1962. There have been other periods of as long as five years when monthly mean salinity was almost always above 1.0 ppt (1966 through 1971).

RESPONSE C.1.12: There are several references to surface and bottom turbidity levels near dredges in both the EIS (pages EIS 37-38 of the DEIS and 51-53 of the FEIS) and in Appendix C. The discussion on page 43 of the DEIS dealt with surface turbidity, without any direct or indirect implications regarding the relative levels of bottom turbidity.

RESPONSE C.1.13: The topic has been adequately addressed in Appendix C, and an additional paragraph referencing that discussion has been added to page 60 of the FEIS.

RESPONSE C.1.14: Estimates of shrimping intensity in Lake Pontchartrain are not available.

RESPONSE C.1.15: There are various sources of sediment which can affect the turbidity levels in Lake Pontchartrain. They are:

1. Flood waters from the Mississippi River Basin which at one time overflowed naturally into Lake Pontchartrain, but now can only flow directly into the lake through the Bonnet Carre' Spillway;

2. Flood waters from the streams which empty into Lake Pontchartrain, especially the Amite River via Lake Maurepas;

3. The bottom of Lake Pontchartrain itself which is disturbed by shell dredging, shrimp trawls, and weather fronts and their wind systems which cause wind-induced mixing;

4. Shoreline erosion and loss of marsh surrounding Lake Pontchartrain through deterioration and subsidence;

5. Sediment-laden water entering Lake Pontchartrain through The Rigolets and Chef Menteur Pass, the major sources of water to the lake. The sediment can be from flood waters from the Pearl River or flood waters from the Mississippi River which have entered the Gulf below New Orleans.

Turbidity is a measure of water clarity. Sediment is only one variable which can affect turbidity. Algal growth can also reduce the clarity of water, increasing the turbidity of the water. This is especially true with the type of measurement used by many to represent turbidity in Lake Pontchartrain, Secchi disc depth measurements, which measure transparency of the water.

Stone et al., (1980) reported that water transparency or clarity has decreased between 1953 and 1978 by over 50 percent. The basis for this conclusion is Secchi disc data collected in 1953-55, 1968, 1976, and 1978. The mean Secchi disc depth readings shown on Figure 3 in Stone (1980) were as follows:

1953-55	140 cm
1968	92 cm
1976	86 cm
1978	61 cm

However, in Stone and Deegan (1980), Secchi disc depth readings of 117 cm for 1953-55 and 72 cm for 1978 are used in a Lake Pontchartrain ecosystem model. Thompson and Fitzhugh (1985) also presented some Secchi disc depth readings for Lake Pontchartrain. Mean monthly depths for the entire Lake Pontchartrain were displayed for July 1953-May 1955, September 1972-August 1974, January-December 1978, March-November 1982, and January-December 1983. Thompson and Fitzhugh reported that the maximum lake averages decreased close to 50 percent with noticeably lower maximums and minimums. Thompson and Fitzhugh also illustrated the

relationship between lake water clarity and overall salinity regime. They concluded that the average turbidity increased in low-salinity years and decreased in high salinity years. Any predictions concerning trends in turbidity must also consider the trends in overall salinity.

A cursory review of these data would lead one to believe that the increase in turbidity in Lake Pontchartrain is a "long term" trend. However, each year had different hydrometeorological conditions. From September 1950 through May 1953, the southeastern climatic division of Louisiana was experiencing mild to moderate drought conditions which certainly lowered turbidity levels in Lake Pontchartrain with little runoff contribution from streams entering Lake Pontchartrain. These drought conditions would influence turbidity levels throughout 1953. The months of September and October 1954 were the highest periods for salinity known for Lake Pontchartrain. Thompson and Fitzhugh characterized the 1953-55 period as a period with high salinity conditions.

The year 1968 was the beginning of a three-year period of below normal precipitation in the same climatic division. The Bonnet Carre' Spillway was open for 86 days in 1973 and 35 days in 1983. Heavy rainfalls fell in the Lake Pontchartrain area in 1978; winter storms increased turbidity levels. The streams entering Lake Pontchartrain were in flood in 1983, contributing to the turbidity in the lake. In fact, Thompson and Fitzhugh reported that the Pearl, Tangipahoa, Natalbany, Tickfaw, and Amite Rivers experienced their highest mean annual river discharge in 1983 for the period 1944-1983, with the Tchefuncte River experiencing its second highest. And finally, the Bonnet Carre' Spillway was operated 4 times between 1973 and 1983 after a considerable period of non-flood years in the Mississippi River Basin (1951-1972).

To conclude, only by equating hydrometeorological conditions can long-term trends be assessed, let alone be quantified. Thompson and Fitzhugh also concluded in their report that they could not make

meaningful interpretations on what the numerous measurements show about the dynamics of Lake Pontchartrain water clarity or sediment load.

Some generalities can be made, however, about the effects of sediment inputs from the Bonnet Carre' Spillway. Every time the Spillway is opened, turbidity increases in Lake Pontchartrain. The data substantiate this. When the Spillway is open, the majority of the material in suspension entering Lake Pontchartrain is silt and clay. The sediment can either deposit on the bed or be flushed out of the lake, as Lake Pontchartrain has a flushing time of about 30 days during Spillway operations. Because of the increase in urban and rural development in the basins of rivers which empty into Lake Pontchartrain, particularly the Amite River, flooding has increased, and probably sediment load as well. Given the same hydrometeorological conditions, turbidity in the lake as a result of a rainfall event north of the lake would be higher now than in the past.

RESPONSE C.1.16: Information has been added to Section 3.4.2.1.2 of the EIS to address the concerns expressed in this comment (see pages 37-43 of the FEIS).

RESPONSE C.1.17: Data regarding Lake Maurepas sediment quality has been added to the "Sediment Quality - Contaminants" Section of Appendix C (see pages C-53-57 of the FEIS).

RESPONSE C.1.18: Discussions regarding the distribution and effects of polycyclic aromatic hydrocarbons (PAH's) have been added to the section "Sediment Quality - Contaminants" in Appendix C (see pages C-34 and C-49-50 of the FEIS).

RESPONSE C.1.19: Concerns expressed in this comment have been addressed in Responses C.9.9, C.9.11, and C.9.28.

RESPONSE C.1.20: Turner (1980) estimated a 30 percent reduction in areal extent of widgeongrass and wildcelery between 1954 and 1973. The 30

percent does not necessarily apply to grassbeds as a whole because there was also an expansion in other species during this time. It is true, however, that there was a documented 50 percent decline in the areal extent of grassbeds between 1973 and 1986. It is acknowledged that the long-term increase in turbidity in the lake is possibly one of the major reasons for the decline. The impact of shell dredging on long-term increases in lakewide turbidity is a very complex issue. It is our position that the contribution of shell dredging to the long-term turbidity increase cannot be quantified and, in accordance with 40 CFR Part 1502.22, information has been added to section 3.4.2.3.2 of the FEIS to address this issue.

RESPONSE C.1.21: It is possible that the short-term turbidity plumes reach areas where grassbeds once grew. However, it is highly unlikely that short-term turbidity from shell dredging is preventing these areas from supporting vegetation for several reasons. The areas that historically supported and presently support most of the grassbeds are in the eastern portion of the lake where salinities are higher and the turbidity plumes are relatively short-lived. Even if the plumes reached these areas, it is highly unlikely they would persist long enough to harm grassbeds. The apparent long-term increase in average lakewide turbidities are probably of far greater consequence with regard to impacts to grassbeds. It must be remembered that any grassbeds that occupy the lake must be tolerant of the high levels of turbidity that often occur due to winds and riverine input. The same was true of the grassbeds that occurred historically.

RESPONSE C.1.22: Based on available information, it is not possible to determine historical trends in species composition and abundance from the 1950's to the 1980's. Phytoplankton populations are one of the most dynamic components of an estuarine ecosystem. Although species abundance varies considerably due to various physical and chemical environmental factors, species composition does not vary significantly. Riley (1967) states that phytoplankton is often abundant quantitatively, but the number of important species is limited, with a single species, e.g.,

Coscinodiscus, being dominant at any given time. In Lake Pontchartrain, the phytoplankton community is characterized by temporal and spatial variabiltiy as the organisms respond rapidly to changes in their environmental milieu (Dow and Turner, 1980).

There is no question that increased turbidity decreases the photic zone and, all other factors being equal, reduces phytoplankton productivity. Relatively high turbidity in Lake Pontchartrain may decrease the annual primary production in spite of a uniform rate of potential photosynthesis from March through December (Dow and Turner, 1980), although other factors, particularly nutrient levels, play a major role in productivity. Lake Pontchartrain is classified as meso- to oligotrophic, which implies low productivity and low nutrient enrichment within the lake itself (Witzig and Day, 1980). However, based on an extensive review of annual primary production by Platt and Subba Rao (1973), Dow and Turner (1980) reported that annual primary production for Lake Pontchartrain averaged about the same as for 22 nearshore coastal systems and embayments spread throughout the tropical and temperate oceans of the world.

It is acknowledged that shell dredging may contribute to the long-term increase in average lakewide turbidity. However, it is our position that the contribution of shell dredging to the long-term turbidity increase cannot be quantified and, in accordance with 40 CFR Part 1502.22, information has been added to section 3.4.2.3.2 of the FEIS to address this issue.

RESPONSE C.1.23: Populations of large, live Rangia still exist in many of the areas of the lake where dredging is prohibited. These clams release gametes directly into the water and the eggs and subsequent larval stages are spread to other areas of the lake by winds, currents, and tides. This is why small Rangia are still encountered at sampling stations throughout the lake.

RESPONSE C.1.24: Information has been added to the EIS and the paragraph preceding the calculations in Appendix D to indicate that the calculations reflect only the area directly disturbed by passage of the fishmouth and that additional areas adjacent to the actual dredge cut are affected by a thin layer of fluid mud, even though the DEIS and appendixes already discuss the area affected by fluid mud impacts in several areas.

It is acknowledged that it takes from 8 to 21 months for the benthic populations to recover to predredging conditions. This information was presented in the DEIS. As a result, benthic habitat in some areas of the lake is subjected to a depressed level of production. However, some opportunistic organisms, such as the very abundant hydrobiid gastropods, populate the areas in a matter of weeks. It should also be pointed out that it is unlikely that the thin layer of fluid mud is lethal to all of the organisms in the areas it affects. Benthic studies conducted in recent years still report thousands of benthic organisms per square meter.

As shown in Figure 5 of the EIS, the lake is divided into zones and a dredging schedule is established annually by the Louisiana Department of Wildlife and Fisheries. Although the zoning and dredging schedule is established primarily to reduce user conflicts between the shell dredgers and commercial and recreational fishermen, it also serves to reduce pressure on benthic habitat and allow some recovery of benthic organisms. The following is the schedule for 1987.

MONTH	ZONES	MONTH	ZONES
January	8-2-A	July	8-3-A
February	2-5-A	August	3-7-A
March	2-7-4	September	5-6-A
April	3-7-4	October	4-7-A
May	6-3-A	November	8-2-A
June	8-5-A	December	8-4-A

RESPONSE C.1.25: The document referred to in this comment was authored by W.B. Sikora, J.P. Sikora, and A. McK. Prior and was published in 1981. Information from that document, as well as the Sikora and Sikora study "Ecological characterization of the benthic community of Lake Pontchartrain, Louisiana," published in 1982, was used in the EIS and appendixes and literature citations for those documents appear in the Literature Cited for the EIS and Appendixes C and D. It is not practical to report fully in the EIS on all of the studies that have been conducted in the lake. It is the Corps' position that sufficient information from the Sikoras' studies were used in preparation of the EIS and appendixes.

RESPONSE C.1.26: The EIS states "there are no data to document that the changes that have occurred in the benthic community have adversely impacted fish and wildlife resources or overall lakewide productivity." The phrase, or overall lakewide productivity, has been deleted from the statement. It was intended to refer only to fish and wildlife resources at a higher level in the food chain. However, since it is acknowledged that benthic populations have been dramatically altered by dredging, and that productivity of phytoplankton and grassbeds may have been affected by the long-term increase in turbidity, to which shell dredging may contribute, the phrase is misleading.

The EIS acknowledges that the dramatic decline of large, live *Rangia* has caused a reduction in benthic biomass in the areas where dredging is permitted. This cannot be disputed; however, there is no indication that there is a direct relationship between benthic biomass and fishery production in Lake Pontchartrain. As noted in the EIS, few species consume large *Rangia*. The blue crab, which is very abundant and supports the primary commercial fishery in the lake, consumes large *Rangia*, but landings from 1959 to 1984 show no discernible downward trend. Further, open water habitats are not a limiting factor to fishery production in coastal Louisiana. It is well documented that nearshore areas of lakes, bays, and other large water bodies are more heavily utilized by fishery resources. The benthic populations in nearshore Lake Pontchartrain are not directly impacted by shell dredging.

The comment states "Rather than acknowledge the complexity of the many changes induced in the benthic community, the DEIS bases its assessment of the significance of benthic impacts solely on an inventory of organisms which feed directly on Rangia." On the contrary, the DEIS and appendixes acknowledge the complexities of impacts to benthos, fisheries, and the overall lake ecosystem, which is inferred in this commentor's general comments C.1.1 and C.1.2. For example, the potential importance of Rangia fecal production to the lake ecosystem was mentioned on page D-29 of the DEIS.

Thompson (1984) made several conclusions regarding the fishery communities in Lake Pontchartrain from 1953-1978. Overall, there was remarkable stability for most of the abundant species over the 25 year period. The bay anchovy and Atlantic croaker remained the most abundant-most frequently taken. A group of about six or seven common species remained in about the same position over the 25 years. The major changes were associated with positions and presence or absence of rare or occasional species. Data from this analysis points to reasonable stability in the overall Lake Pontchartrain fish community, a conclusion reached earlier by Thompson and Verret (1980). Thompson further stated "The fish community of Lake Pontchartrain, while undoubtedly impacted by many natural and anthropogenic perturbations, remains relatively stable and reasonably healthy."

RESPONSE C.1.27: Although it is well documented that major changes have occurred in the benthic community since the first studies were conducted in the early 1950's, there is no evidence that the change has been progressive, i.e., that the benthic community has declined on an ongoing basis from 1933 to present. Prior to those studies, shell dredging had occurred for about 20 years, with an average annual harvest of 579,000 cubic yards from 1936 to 1953. In the three years prior to Darnell's studies, harvest averaged about 2 million cubic yards. Although it is reasonable to assume that changes occurred in the benthic community as a result of dredging in those first 20 years, it must be recognized that shells were extremely abundant at that time and the levels of harvest

were probably achieved with relatively little effort and bottom disturbance. It is likely that the benthic community that existed in much of the lake when Darnell conducted those early studies was similar to the community that existed in the lake prior to shell dredging. However, in the years that followed, the volume of shell harvest increased significantly. In the 1960's, harvests ranged from 3-5 million cubic yards. Production peaked in 1975 with a harvest of over 7 million cubic yards. The EIS and appendixes make it very clear shell dredging has contributed to major changes in the benthic community. The community that existed in the 1950's was dominated by the large Rangia and the community that dominates today is characterized by a suite of smaller, more opportunistic organisms. The present-day community has likely been in existence for at least 10-15 years and there is no reason to believe it would change significantly if shell dredging persists under current conditions.

RESPONSE C.1.28: As noted in our previous response, we concur that the benthic community under pre-dredging conditions was likely similar to those found by Darnell in the early 1950's and have modified our discussion of the "no action" alternative accordingly. We are well aware of Darnell's studies, the Sikora et al., (1981) study, and the transect study conducted by Roberts (1981), and have discussed those studies in the EIS and appendixes. The Sikora et al., (1981) study did indeed track the recovery of benthic communities in a dredged and control site adjacent to the Causeway, but the communities at the start of their study were by no means the same as those reported by Darnell in the 1950's. Although estimates of recovery times at the dredged station ranged from 250 to 650 days, the "recovered" community was not the same as the benthic community that existed when Darnell conducted his studies, particularly with regard to large Rangia.

With regard to the projected ecological status of the affected area if the dredging is continued for another five years with the projected condition if the dredging is halted now, we offer the following and have modified the "no action" impacts section accordingly.

Due to the life cycle and environmental requirements of Rangia, it takes a number of years for widespread populations of large Rangia to become established. All other factors being equal, if bottom sediments were not disturbed on a regular basis by shell dredging, benthic communities could begin to recover and approach to some degree those that existed years ago. However, it must be pointed out that other perturbations that have affected the lake could delay or preclude the recovery of benthos to predredging conditions.

RESPONSE C.1.29: Information in the DEIS indicates that there has been a decline in some demersal fish species. With regard to the decline in species diversity and species richness, see Response A.3.17. In the DEIS and appendixes, the discussion of impacts to fisheries as a result of shell dredging was not limited to direct food chain effects. Impacts of turbidity, suspended sediments, lowered dissolved oxygen, siltation, and other factors were also discussed. Additional information has been added to the summary paragraph on pages 89-90, including comments concerning the potential impacts of long-term turbidity on fishery production.

The EIS and appendixes clearly acknowledge that shell dredging has played a major role in reducing benthic biomass by dramatically reducing abundance of large Rangia. The impacts of this reduced biomass are discussed in Response C.1.26.

RESPONSE C.1.30: The fact that blue crabs consume large Rangia was acknowledged on page D-46 of the DEIS and has also been cited in other areas of the FEIS. The DEIS also acknowledges the value of the commercial blue crab fishery in the lake.

The blue crab fishery in Lake Pontchartrain, while accounting for the greatest volume of catch, represents a lesser-valued fishery than shrimp. Recognizing that data collection for both fisheries is extremely poor and is aggregated with Lake Borgne after 1975, statistical analysis demonstrates no significant decline in the crab fishery over the last 25 years, and in fact shows substantial growth over the last decade. The

long-term correlation with dredging activity *per se* is statistically very poor (R squared = 0.24). When corrected for inflation, the price of the product has declined, indicating reduced rather than increased demand. The shrimp fishery, incidentally, has in fact grown in productivity over this same period.

RESPONSE C.1.31: According to the U.S. Fish and Wildlife Service (1984), approximately 25 % of the emergent marshes and forested wetlands in the Lake Pontchartrain-Borgne estuarine complex were lost between the mid-1950's and 1978. Prior to and during this period, the swamps and marshes around Lake Pontchartrain proper suffered serious losses due to extensive residential and commercial development along the south shore and to a lesser extent along the north shore. These wetland losses have affected the overall productivity of the lake ecosystem and as a result a discussion of these losses was included in the cumulative impacts section. Further discussion of wetland losses is beyond the scope of this EIS. Shell dredging has had no impact on loss of wetlands surrounding the lake. The Corps is not required to consider the effects of activities that lack sufficient interrelationship with shell dredging to produce "cumulative impacts." In the cumulative impacts analysis, the Corps is required to consider the extent of the interrelationship among various actions as well as practical considerations of feasibility. These limitations were taken into account by the Corps in a very reasoned cumulative impacts analysis in the DEIS.

RESPONSE C.1.32: Comment noted.

RESPONSE C.2.1: Scoria and limestone have to be brought in from out of state. Existing quantities of flourogypsum, phosphogypsum, recycled concrete, spent bauxite, and steel slag are limited when compared with others, which can essentially be considered unlimited. Newspaper articles have indicated that 12 million tons of phosphogypsum was proposed to be dumped into the Mississippi River.

RESPONSE C.2.2: The applicants presently handle various quantities of other aggregate materials including limestone, sand, and gravel.

RESPONSE C.2.3: See discussions in Section 2.2.3.2 and Response C.10.3.

RESPONSE C.2.4: About 150,000 tons of limestone was used for aggregate in the New Orleans area in 1986. It was primarily used as course aggregate in asphaltic concrete.

RESPONSE C.2.5: As discussed in Section 3.6.3.2, a restructuring of the industries supplying aggregate to the New Orleans area will result in the loss of an estimated 725 local jobs. The report has been revised to acknowledge that adverse impacts to the national economy could be partially offset by increased employment in the production of alternative materials elsewhere. The net national employment effects of making such a market adjustment locally, however, are not known at this time.

RESPONSE C.2.6: The purpose of this EIS is to assess the impacts of dredging clam shells from the lakes area. It is acknowledged that there are environmental impacts associated with the extraction of other materials, but it is beyond the scope of this study to evaluate them.

RESPONSE C.2.7: Other materials can be used for <u>most</u> applications, but at a far greater cost to the taxpayer. Some alternative materials will require testing over a period of time before they are approved for use. The Corps and its contractors used about 510,000 cubic yards of shell in 1986 and have used about 650,000 cubic yards of shell through August

1987. The amount of shell used by the Corps in 1987 is higher than normal due to a large number of dike repair jobs along the Mississippi River, particularly at the passes.

RESPONSE C.2.8: In a study conducted by the Louisiana Department of Wildlife and Fisheries (Chatry, 1986), limestone displayed greater spat catch than clam shells. However, as acknowledged in their report, other factors require consideration and more studies are necessary, particularly since limestone is about 1.6 times heavier than clam shells and would tend to sink in the soft sediments where cultch is normally required. Additionally, limestone is about 60 percent more expensive than shells. The Department always uses clam shells for cultch material on state-managed bottoms.

Shell is superior based on its use. Limestone is too heavy. Another possibility, based on its density only, includes scoria, which must be brought in from Mexico.

RESPONSE C.2.9: Your comment is entirely correct (see Table 11 in Section 3.6.6.1). The third paragraph of Section 3.6.5.1 has been revised accordingly (see page 116 of the FEIS).

Sand is abundant in Louisiana, however, construction uses are primarily for embankments and fill. Sand base course requires an admixture of shell, limestone, or gravel to meet stability specifications. Gravel is abundant in the Florida Parishes and serves many of Louisiana's construction needs such as concrete aggregate and bituminous aggregate, as well as course aggregate binder in sand/clay base course. Gravel base course does not perform as well as shell in "bridging" over unstable coastal soils south of U.S. Highway 190 in south Louisiana.

RESPONSE C.2.10: Turner *et al.*, (1980) compared the submerged macrophytes of Lake Pontchartrain in 1954 and 1973. They found that widgeongrass and wildcelery, the only two submerged grasses found in the

lake in 1954, occurred in a narrow band along the southern shore of the lake from just east of Bayou St. John to South Point. These two points of reference are shown on Figure D-2.

RESPONSE C.2.11: The potential causes for the decline in acreage and species composition of the grassbeds in Lake Pontchartrain were reviewed by Mayer (1986) and are listed on page D-5.

RESPONSE C.2.12: It is true that increased shell dredging, increased turbidity, and a decline in grassbeds occurred from the 1950's to the 1980's. However, it is not possible to make any meaningful conclusions regarding the correlation of these factors. It is acknowledged that shell dredging may have contributed to the long-term increase in turbidity, although the extent is unknown (see Response A.3.10 and additional information added to Section 3.4.2.3.2 of the FEIS). However, as discussed in the EIS, appendixes, and other studies referenced in our documents, a variety of factors other than shell dredging have been implicated in the apparent increase in turbidity. According to Thompson and Fitzhugh (1985), hypothesized causes for decline in lake clarity include introduction of fine sediments from the Bonnet Carre' Floodway, resuspension of sediments from dredging, increased commercial and recreational shrimping, increased loads from altered river discharges, reduction of grassbeds, increased wave action from breaking waves along the New Orleans lakefront seawall, and shoreline sediments being washed into the lake from erosion. Another important contributing factor is the loss of wetlands surrounding the lake. Water that passes through swamps and marshes before entering the lake is less turbid because the wetlands trap sediments. Water that enters the lake as urban runoff through man-made outfall canals is more turbid.

RESPONSE C.2.13: Increased turbidity decreases the depth of the photic zone and limits photosynthesis. It is quite possible that increased turbidity has played a role in decreasing the depth of occurrence of grassbeds in the lake. However, as stated previously, many other factors

also affect distribution of grassbeds and the causes for their decline are likely synergistic in effect.

RESPONSE C.2.14: As required by the Endangered Species Act, the Corps coordinated with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service regarding potential impacts to endangered species as a result of shell dredging. These agencies have jurisdiction over endangered species and are the acknowledged experts regarding these species. Based on correspondence with these agencies, the only endangered or threatened species potentially impacted by shell dredging in the lakes area are the Atlantic ridley and loggerhead sea turtles. Although there have been manatee sighting(s) in Lakes Pontchartrain, the potential for impacts to manatees as a result of shell dredging is insignificant.

RESPONSE C.2.15: Since algae requires solar energy to photosynthesize, increased turbidity could reduce algal productivity. Darnell (1961) reported that much of the bottom throughout the lake consisted of a thin ooze, brown to blue-green in color, which is probably made up largely of precipitated and decaying Anabaena cells mixed with detritus from other sources. He also reported that a type of blue-green algae tolerant of very low light conditions occurs in a layer on the lake bottom throughout the lake. The effects of turbidity on the blue-green layer on the bottom may be to limit phytoplankton production, thereby reducing the contribution of the phytoplankton rain to the bottom detritus, and to reduce photosynthesis in the living algae.

Reference is made to comment letter B.5. On June 19, 1987, at the request of the Attorney General's Office, State of Louisiana, Dr. Darnell conducted a one-day field trip to sample the sediments and benthic fauna in Lake Pontchartrain. In comment B.5.11, Dr. Darnell reported that the surface coating of blue-green algal ooze is still recognizable at many of the stations examined, although it is extremely thin.

RESPONSE C.2.16: *Rangia* do not form distinct reefs as do oysters, rather they were historically distributed throughout the bottom of the lakes area. Populations of *Rangia* inhabited the lakes area for thousands of years and many generations of clams have lived and died in the area. The shells harvested by the shell dredgers are primarily fossil shells. Most of the large, live, *Rangia* were harvested by the late 1960's to early 1970's. Live *Rangia* are not exposed and do not provide substrate for benthic organisms. The live clams are generally buried by a layer of sediment. Although their siphons are able to maintain contact with the overlying water, their shells are not exposed. However, fossil shells and shell hash, which provide substrate for certain sessile organisms and were historically abundant on the lake bottom, are less abundant as a result of shell dredging activities.

RESPONSE C.2.17: Populations of large, live *Rangia* still exist in many of the areas of the lake where dredging is prohibited. These clams release gametes directly into the water and the eggs and subsequent larval stages are spread to other areas of the lake by winds, currents, and tides. This is why small *Rangia* are still encountered at sampling stations throughout the lake.

RESPONSE C.2.18: The EIS was not limited to two alternatives, rather only two alternatives were considered in detail. A variety of other alternatives were discussed in the alternatives section of the document and explanations for their elimination were provided. For further information, refer to Response B.4.3.

RESPONSE C.2.19: As discussed in Sections 3.6.1.2, 3.6.2.2, 3.6.3.2, and elsewhere in the report, the phasing out of shell dredging operations in the lakes area prior to depletion of the resource would result in a premature restructuring of the local aggregate production and supply industries, including the loss of an estimated 725 local jobs over the 1, 3, or 5 year period.

RESPONSE C.2.20: Pages EIS 18-21 in the DEIS consist of a comparative impacts table. The purpose of this table is to provide reviewers with a brief overview of impacts. Shell dredging is a very complex and controversial issue. The EIS and appendixes provide extensive supporting information for the brief statements presented in the table. If the reviewer questions information in the table, he must investigate the matter further.

RESPONSE C.2.21: The commercial fishing industry in the lakes area is discussed at length in Section 3.6.1.1. As shown in Table 8, the estimated exvessel value of hard blue crab landings in 1985 was $926,000. If a multiplier factor of 3 was applied, the gross value would be $2,228,000. If the blue crab harvest is, in fact, six times that of the reported catch (Roberts and Thompson, 1982), the gross value of the 1985 estimate would be $5,556,000. Applying a multiplier of 3, the gross value would be $16,668,000, significantly less than the gross value of the 3 million cubic yard clamshell harvest. The estimated gross value of 3 million cubic yards of clam shells is $33,900,000; multiplied by 3, its gross value would be $101,700,000.

RESPONSE C.2.22: Total catch in the Lake Pontchartrain/Borgne fishery has increased over the period 1963-85. Over the period 1963-75, for which separate data on Lake Pontchartrain are available, catch has also grown. The two largest components of this fishery, shrimp and blue crab, have shown no statistically significant trend toward growth or decline during the 1963-85 period. Since 1975, however, the crab catch has increased substantially. Correlation with dredging activity *per se* is in both cases low (R squared = 0.25). Statisical inferences taken from the available fisheries data, however, should be viewed with caution since substantial under-reporting occurs.

RESPONSE C.2.23: Section 3.5.2.2 of the EIS as well as the fisheries section of Appendix D discuss the changes in abundance and frequency of occurrence of fish species in Lake Pontchartrain from 1953 to 1978. Sand

seatrout remained a common member of the community, but exhibited a strong decline in frequency of occurrence. Spot and southern flounder both exhibited declines in abundance and frequency of occurrence. All three of these demersal fishes are of recreational and/or commercial value. No single factor has been identified as causing these changes. A variety of factors have been implicated and are discussed extensively throughout the EIS and appendixes. Thompson and Fitzhugh (1980) stated "the causes of this decline are certain to be a complex interaction from changes in turbidity, nutrient levels, loss of preferred habitat, reduced amount of available food, additional fishing pressure, and other known perturbations in the lake.

RESPONSE C.2.24: Studies done during preparation of the EIS have found no statistical evidence which links shell dredging in the lakes with a decline in fisheries employment. From 1976 to 1986, clamshell production in Louisiana declined (as has production of sand and gravel). The Bureau of the Census indicates that "Forestry and Fisheries" employment of people living in the parishes adjacent to the lakes has increased from 1,051 in 1960 to 1,372 in 1980. The figure for 1960 represented 19.1 percent of the state total in this employment category. The figure for 1980 represented 19.9 percent of the state total. A comparison between timber production in this area with the state total suggests that the majority of the jobs reported for parishes around the lakes involve commercial fishing. Table 8 of Section 3.6.1.1 shows that blue crab landings since 1979 have actually increased. According to information reported in Thompson and Fitzhugh (1985), commercial fishing licenses sold in the study area have also increased.

RESPONSE C.2.25: Under certain conditions, shell dredging can cause turbidities in parts of Lake Pontchartrain to exceed state standards. The applicants are currently operating under valid water quality certificates issued by the Louisiana Department of Environmental Quality (DEQ). However, DEQ has gathered additional data regarding turbidity in both Lakes Maurepas and Pontchartrain. At this time, DEQ has determined

that shell dredging with the current extraction methods and treatment technology cannot be authorized in Lake Maurepas because of water quality impacts. The water quality impacts documented in Lake Maurepas are the persistence of extreme turbidity levels in exceedance of the Louisiana Water Quality Standard for turbidity. However, DEQ has also determined that the Lake Pontchartrain water quality regime is quite different from Lake Maurepas with regard to turbidity effects. The difference is a function of salinity, sedimentation patterns, lake area, and lake depth. Because of these factors, turbidity effects are not widespread and not persistent under most hydrologic conditions in Lake Pontchartrain.

Louisiana law and DEQ regulations adopted pursuant thereto require all discharges to obtain permits from DEQ. Therefore, DEQ has required the shell dredgers to obtain wastewater discharge permits for the dredging activities in Lake Pontchartrain. Each of the companies has applied for a discharge permit and a draft proposed permit has been prepared for each company. The purpose of the discharge permits is to regulate the activity (shell dredging) so that applicable water quality standards for the receiving water body (Lake Pontchartrain) are not violated.

The currently proposed draft permits would require the shell dredgers to monitor the water in Lake Pontchartrain for temperature and turbidity in the area where active dredging is taking place. Monitoring would be required once per week for each calendar week in which any dredging occurs. DEQ plans to establish 15-20 fixed stations in each area (identified by LORAN coordinates) and monitoring would be required at those stations. Temperature would be required to be monitored at a depth of one meter and turbidity at depths of one meter beneath the surface and one meter from the bottom. Should the area-wide arithmetic mean of surface turbidity readings exceed 50 NTU's on any day, then the dredging companies would be required to notify DEQ on that day and monitoring in that area would be required to be reported immediately, by telephone, to DEQ and procedures for mitigation would be determined. Mitigation could include such things as partial or complete discontinuation of dredging

activities until turbidity levels have demonstrated recovery, or a movement of dredging operations away from heavily impacted areas. The results of all analyses would be required to be submitted to DEQ every three months in Discharge Monitoring Reports.

RESPONSE C.2.26: Comment noted.

RESPONSE C.2.27: Comment noted.

RESPONSE C.2.28: Comment noted.

RESPONSE C.2.29: Comment noted.

RESPONSE C.2.30: Comment noted.

RESPONSE C.3.1: The Corps regulates shell dredging through its regulatory permitting program. The permits contain special and general conditions to avoid environmental and navigation impacts. A copy of the regulations is contained in Appendix B. The Corps itself does not monitor the shell dredging industry, but relies on the state to monitor and enforce the restrictions.

RESPONSE C.3.2: It is acknowledged that the Louisiana Department of Wildlife and Fisheries (LDWF) receives royalties from shell dredging. Royalties paid to the LDWF from 1975 to 1985 are shown on Table 7 of the FEIS.

RESPONSE C.3.3: The upcoming decision whether or not to renew permits in Lake Maurepas will be based on information presented in the FEIS and as a result of the public interest review to be completed prior to making a decision on the permits.

RESPONSE C.3.4: The EIS identifies pertinent information provided by the shell dredging industry and its consultants. It is perfectly acceptable to use information from the applicant and their consultants when preparing an EIS. Corps' regulations setting forth environmental operating procedures and documents for regulatory functions (33 CFR Part 230, App. B 10(f) specifically authorize the District Engineer to utilize information prepared by a consultant employed by the applicant so long as the District Engineer conducts an independent evaluation of the information submitted and its accuracy.

RESPONSE C.3.5: Rangia do not form distinct reefs as do oysters. They were historically distributed throughout the bottom of the lakes area. Populations of Rangia inhabited the lakes area for thousands of years and many generations of clams have lived and died in the area, thus providing the substantial numbers of fossil shells harvested by the dredges. At present, fossil shells are still distributed throughout the lake bottom, with populations of large, live clams still inhabiting the periphery of the lake.

RESPONSE C.3.6: Thompson and Fitzhugh (1985) reported on the number of commercial crab licenses issued for eight parishes surrounding Lake Pontchartrain. From 1978-1983, a total of 331-491 licenses were issued for the eight parish area, with an average of 408 licenses per year. For the same area from 1976-1983, a total of 3,617-7,161 commercial shrimp licenses were issued, with a steady increase in number of licenses issued over the eight-year period. It is probable that most of the individuals holding crab licenses for the eight parish area crab in Lakes Pontchartrain. However, many of the individuals from the eight parish area holding shrimp licenses probably shrimp in other areas as well. Oysters are not harvested from Lake Pontchartrain, as the lake is closed to oyster harvest due to pollution from adjacent urban areas.

No information is available concerning frequency of use for any of these activities.

RESPONSE C.3.7: Information regarding recreational fishing and shrimping licenses and boat registrations for the parishes surrounding the lakes is presented in Section 3.7.6 of the EIS.

RESPONSE C.3.8: Swimming in Lake Pontchartrain, particularly in nearshore areas, is not recommended due to high bacterial counts from sewage and stormwater runoff. As discussed in Section 3.8.1 of the EIS, inordinately high bacterial densities impair primary contact recreation uses of the lake within the area extending from the shoreline to about 0.25 miles offshore in Jefferson and Orleans Parishes. A similar diminution of uses occurs at isolated locations along the north shore within about a 200-yard radius of where streams enter the lake. Generally, municipal wastewater discharges to not inhibit primary contact recreational uses of the more central portions of the lake.

RESPONSE C.3.9: Impacts of shell dredging on these activities is negligible and no further discussion is warranted.

RESPONSE C.3.10: The EIS and appendixes present extensive information regarding benthos, fisheries, grassbeds, water quality, and clarity. Where information is incomplete or unavailable, the EIS has acknowledged this fact and has complied with guidance set forth in 40 CFR 1502.22 (see Section 3.4.2.3.2 of the FEIS.

RESPONSE C.3.11: A histogram showing the harvest of shells from the lakes area from 1936-1985 is presented in Figure 2 of the EIS. As discussed in Response C.3.5, clams do not form distinct reefs conducive to mapping. Rather, they are distributed throughout the lake sediments. In the early years of shell dredging, both live clams and fossil shells were harvested; however, the numbers of live clams gradually decreased and today very few live clams are harvested.

RESPONSE C.3.12: Except for recreational swimming, the relationship between the safety of water for swimming and potential commercial or recreational use is unclear. As discussed in Response C.3.8, the reason that portions of the lake are unsafe for swimming has nothing to do with shell dredging. In fact, the nearshore areas where swimming is unsafe are areas in which shell dredging is prohibited.

RESPONSE C.3.13: Section 3.6.1.1 of the EIS has been revised to include additional data on the significance of commercial and recreational fishing in the lakes area and the multiplier effect of harvesting these resources. An analysis of the indirect impacts to other economic entities dependent on the lake is beyond the scope of this report; however, no significant social or economic adverse impacts by these entities have been suggested or identifed under any alternatives considered. See also Response C.2.21.

RESPONSE C.3.14: In the lakes area, no projects to mitigate impacts of shell dredging have been undertaken.

RESPONSE C.3.15: The items listed in this comment have nothing to do with assessing the impacts of shell dredging nor are they interrelated to

shell dredging from a cumulative impact standpoint. Therefore, discussion of these matters is beyond the scope of the shell dredging documents.

RESPONSE C.3.16: Section 3.8.7 of the EIS discusses the impacts of other activities permitted by the Corps in the lakes and adjacent wetland areas. Any discussion of Corps-permitted activities outside of the shell dredging study area is beyond the scope of the shell dredging documents.

RESPONSE C.3.17: Section 3.4.2.3.1 of the EIS presents information which demonstrates that dredging in Lake Maurepas clearly generates lakewide turbidity readings well in excess of the 50 NTU state standard. Information generated in the last few years by DEQ also indicate that shell dredging in Lake Pontchartrain can, under certain conditions, cause turbidities to exceed state standards in certain portions of the lake. It is beyond the scope of this document to include specific reference to all shell dredging generated turbidity readings exceeding state standards. However, Response C.2.25 should ameliorate concerns regarding future turbidity violations in Lake Pontchartrain.

RESPONSE C.3.18: DEQ closed shell dredging in Lake Maurepas because studies conducted by that agency in 1983 and 1984 clearly demonstrated that shell dredging caused turbidity to exceed state water quality standards. Turbidities exceeded state standards on a lakewide basis and persisted for a long period of time. The primary reasons for turbidity problems in Lake Maurepas likely include the following:

- low salinities reduce flocculation and precipitation of suspended solids

- lake is relatively small (about 15% of the size of Lake Pontchartrain)

- water exchange is limited

- fine sediments from tributary input (primarily Amite River) are widely distributed over the lake bottom

- lake is shallow (averages about 7 feet)

Prior to 1983, dredging nad not been conducted in Lake Maurepas since 1968, so there had been no opportunities to investigate dredge-induced impacts in that lake.

RESPONSE C.3.19: Scoping identified several generic alternatives. Based on these generic alternatives, the Corps formulated eight specific alternatives and discussed them in the alternatives section of the EIS. For further information regarding alternatives, refer to Response B.4.3.

Response C.3.20: The potential impacts of shell dredging on other endeavors within the lake (principally commercial and recreational fishing) have been acknowledged and discussed throughout the EIS. Evidence gathered in the preparation of this document reveals little or no adverse impacts on other uses of the lake which can be tied uniquely to shell dredging. See paragraphs 2.2.3.2, 3.5.2.2.2, 3.6.1.1, through 3.6.4.1, 3.7.3.2, 3.7.4.1, 3.7.6.1, and 3.7.6.2.

RESPONSE C.3.21: Sand and gravel are not always feasible substitutes, particularly when lightweight materials are needed. Foundation conditions or construction limitations may rule out some alternatives (see Table 1 of the FEIS and Response A.3.5) Also, Section 2.2.1.1 has been revised to present a more reasoned discussion of alternative materials.

RESPONSE C.3.22: It is acknowledged that the shell dredging companies handle aggregate other than shell (see page 98 of the FEIS). In addition, a discussion of estimated employment impacts of permit denial assuming that the existing companies could remain in operation as middlemen continuing to supply the area's demand for alternative materials is presented in Section 3.6.3.2 of the EIS.

RESPONSE C.3.23: See Section 2.2.1.1 of the EIS.

Regarding the last sentence of the comment, the unique building environment of the Louisiana coastal area and the nearby reserves of clam shell represent a fortunate circumstance which rebounds in large part to the taxpayer. Other coastal states enjoy a close proximity to substitute materials, generally limestone, which are competitive with shell in those areas due to lesser transportation costs. Other states either enjoy nearby competetively priced substitutes, or they pay higher prices for imported materials, a burden which Louisiana currently avoids. The EIS describes in both quantitative and qualitative terms the likely impacts on a variety of socio-economic parameters of a loss of this basic building material; the commentor's use of the term "disaster" is assumed to be rhetorical.

RESPONSE C.3.24: See Response C.3.22. The most satisfactory substitute material for most purposes appears to be limestone, which is not produced in Louisiana in significant quantities.

RESPONSE C.3.25: Examining all possible combinations would be very costly and is beyond the scope of this report. Table 1 in Section 2 of the EIS presents several <u>possible</u> (not proven and accepted) combinations.

RESPONSE C.3.26: No precluded alternate use industries have been identified and adverse impacts do not appear to be measureable in terms of impacts on other activities. The most likely alternative to shell for most uses appears to be limestone, which is not produced in Louisiana in significant quantities. The production of shell has a greater chain of localized impacts due to direct effects of production, employment, and income; similar to the effects of the production of petroleum or natural gas, though to a lesser degree.

RESPONSE C.3.27: See revised paragraph 2.2.3.2 of the FEIS.

RESPONSE C.3.28: The reasons for the absence of shell dredging in other Gulf states has been discussed in Section 3.6.1.1 of the EIS.

The amount of clam shells exported to other states is small.

The private companies that dredge clam shells in Lake Pontchartrain are clearly identified on the very first page (Title Page) of the EIS.

RESPONSE C.3.29: Table 7 in Section 3.6.1.1 and data presented in Section 3.6.1.2 show recent historical production trends and the method of calculation of reserves. Technical improvements include the installation of screw classifiers aboard the dredges to allow recovery of finer particles of shell and increase the prospects of recoverable reserves. See also Response C.10.1 which points out that the demand for shell is, in part, influenced by general economic trends. Data furnished by the Louisiana Department of Revenue indicate that production of sand and gravel, as well as shell, has declined over the past decade.

RESPONSE C.3.30: The unharvested clam shells do not appear to have any significant economic value. The value of future production is, by definition, less than the value of present production, barring any significant changes in technology.

With regard to any environmental value that might be attributalbe to unharvested shells, refer to Comments and Responses B.5.9 through B.5.15.

RESPONSE C.3.31: The Corps was cognizant of the Federal court order from the beginning and took care when selecting the significant issues and resources to ensure that the various specific parameters cited in the order were adequately addressed in the document. The Summary of Judicial Requirements on pages S-9 to S-11 of the DEIS was provided to make it easier for the reviewers to locate areas where the judicial requirements were addressed.

RESPONSE C.3.32: The lakes DEIS states clearly on page EIS-2 that a state court has declared all shell dredging leases invalid because they were executed in violation of several state statutes. Nonetheless, the Corps plans to proceed with completion of the EIS since it is obliged to do so by federal court order. Moreover, suspensive appeals have been filed which, at present, delay the impact of this decision. Furthermore, the decision is irrelevant with respect to completion of the EIS, although it may ultimately affect the Corps' authority to grant the permits. Viewing EIS preparation as part of the permit process, nothing in the regulations precludes the Corps from proceeding with the EIS. See 33 CFR 320.4(g) and (g)(6).

RESPONSE C.3.33: Comment noted.

RESPONSE C.4.1: Comment noted.

RESPONSE C.4.2: Additional information regarding alternative materials has been added to the FEIS. As discussed in Section 3.6.1.1, the $33,900,000 figure reported represented a sales price rather than the net economic return from clamshell harvest. As discussed in Section 3.6.5.1, studies done by DOTD and LSU indicate that clam shells have unique qualities which make this resource a superior material for certain uses in coastal Louisiana. No precluded economic activities of significance have been identified; impacts do not appear to be significant or measurable in terms of other activities. The fact that Lake Pontchartrain functions as a nursery area for offshore fisheries and is also valuable for recreational fisheries has been acknowledged in responses to comments and in the EIS. However, information to accurately quantify these values is not available.

RESPONSE C.4.3: The first two sentences of this comment are noted.

With regard to biomagnification and water quality pollution from shell dredging, additional information has been added to the FEIS so reviewers can understand more clearly the relationship of shell dredging to release of contaminants from the sediments and the resultant impacts to water quality and aquatic organisms. Responses to comments regarding contaminants in letter C.9 discuss the matter in more detail.

Continued dredging would not likely cause progressive deterioration of the benthic community (see Response C.1.27). The benthic community would likely remain similar to what it is today. It has been clearly acknowledged in the EIS that the benthic community has changed due to shell dredging and that it is a stressed community characteristic of a perturbed system. It is also acknowledged that the benthic community would recover to some degree if dredging were discontinued (see Response C.1.28 and the impact discussion under the no action alternative in Section 3.5.2.1.2 of the FEIS).

Statements comparing the aquatic communities of Lake Pontchartrain with other estuaries have been made in several locations in the EIS. However, a large-scale comparative study of Lake Pontchartrain with a "comparable" estuary would be a major undertaking and well beyond the scope of this EIS. Further, such a study is not necessary to the formulation of an informed decision whether to grant or deny shell dredging permits in Lake Pontchartrain.

Although it is true that natural levels of benthic and fishery production prior to shell dredging are unknown, the condition of the lake when Darnell conducted his studies in the early 1950's was probably similar to pre-dredging conditions (see Response C.1.27). The EIS has been modified accordingly.

The Sikora's studies have been discussed in the EIS and appendixes and citations for both their 1981 and 1982 studies appear in the EIS, Appendix C, and Appendix D. The statistical analyses conducted by Bloom are contained in the Taylor (1987) report and are therefore not referenced separately in the EIS. The Taylor report was just completed in 1987 and is an unrefereed report. Many reports, including the Sikoras, are never subjected to critical peer review, primarily due to time and funding constraints.

RESPONSE C.4.4: As stated in Response C.1.22 and in the EIS, increased turbidity decreases the depth of the photic zone and, all other factors being equal, limits phytoplankton production. The opinion that phytoplankton production is light-limited in Lake Pontchartrain has merit - phytoplankton production is probably light-limited in any Louisiana coastal estuary. However, review of the literature cited in this comment indicates that nutrients are a very important factor. As reported in Dow and Turner (1980), Hopkinson and Day (1979) reported primary production measurements (g.C/m2/yr) of 611 for Lake Cataouatche, 311 for Little Lake, and 212 for Lake Salvador. Ranges were not given and it is not

clear whether or not these figures represent averages. At any rate, Lake Cataouatche is a very turbid lake, but extremely eutrophic, which probably accounts for the high production figure. Little Lake is extremely mesoeutrophic. No nutrient classification was given for Salvador. Using Hopkinson's approach, Dow and Turner (1980) reported average production of 179 g.c/m2/yr in Lake Pontchartrain. Since Lake Pontchartrain is classified as meso- to oligotrophic, which implies low productivity and low nutrient enrichment within the lake itself (Witzig and Day, 1980), this figure is not that surprising. The contribution of phytoplankton rain to benthic detritus is acknowledged in previous comments and in the EIS.

Many perturbations have affected the lake over the years. Although a decrease in fishery resources may have occurred, it is very difficult to assess. Certainly there have been changes in the the fish communities and it is documented that there have been changes in the frequency of occurrence and abundance of certain species. Additionally, certain uncommon and rare species that occurred in samples in the early 1950's were not encounterd in later studies. Perhaps these species are intolerant of the changes that have occurred. It is interesting to note that during the public hearings and the comment period for the EIS, no fishermen offered any statements or comments regarding a decline of fishery resources in the lake.

The impacts of shell dredging on bottom sediments of the lake have been thoroughly discussed in the comment responses and the EIS. Meaningful studies regarding the increase in turbidities over time would require expensive, long-term studies and would likely require more sophisticated sampling gear than Secchi discs. It would be very difficult to monitor Secchi depths under all conditons, especially during windy periods. Additionally, in order to quantify the impacts of shell dredging on the turbidity increase, they would also have to be conducted over an extended period of time both with shell dredging in place and with shell dredging closed. The inherent variability of the bottom sediments is another factor that would need to be evaluated before

definitive cause-effect determinations could begin to be made. Relative cohesiveness and shear strength of the sediments are important properties that influence resuspension and turbidity generation. These would also need to be monitored over time at particular locations.

RESPONSE C.4.5: The EIS acknowledges that turbidity is one of the factors that may have led to the decline of grassbeds and that grassbeds provide valuable spawning and nursery areas for fish and shellfish. The EIS must assume that the shell dredging industry abides by the restrictions. Although there may be isolated instances in the past where the dredgers have been in restricted areas, in recent years their activities have been monitored and it is highly unlikely they would knowingly dredge in restricted areas.

Literature concerning the impacts of dredging on grassbeds and fishery spawning areas is no doubt extensive and a lengthy treatise could be prepared using this information. Contrary to your comment, the DEIS does not use lack of information as a cover for saying that shell dredging has no proven negative impacts and clearly acknowledges impacts to several components of the ecosystem, particularly the benthos. Extensive information regarding Lake Pontchartrain is presented in the DEIS and appendixes. The FEIS, as a result of both further investigation and valuable comments provided during public review, provides a clear assessment of most impacts. Where data is incomplete or unavailable, the document clearly acknowledges that certain information is missing and states the relevance of the missing information to informed decisionmaking.

RESPONSE C.4.6: Comment noted. With regard to sea turtles, an extensive literature survey was conducted and individuals knowledgeable regarding sea turtles were consulted. A thorough endangered species assessment was prepared and submitted to the National Marine Fisheries Service (NMFS), Appendix A. NMFS commended the Corps on the thorough nature and quality of the assessment. There is no evidence of sea turtles overwintering in the sediments of Lake Pontchartrain, although it is acknowledged that the possibility exists.

RESPONSE C.5.1: A statement regarding the effects of dredging on sediment compactness and its subsequent effects on resettlement and colonization of benthos has been added to the the benthic impacts section of the FEIS.

RESPONSE C.5.2: A statement regarding the use of reef (mud) shells and recycled oyster shells (steam shells) as oyster cultch has been added to Section 2.2.1 of the FEIS.

RESPONSE C.5.3: A description of Lake Maurepas sediments based on information from these references has been added to Section 3.4.2.3.1.

RESPONSE C.6.1: Comment noted. To the best of our knowledge, Florolite is graded florogypsum. Information regarding florogypsum is presented in Table 1 and Section 2.2.1.1 of the EIS.

RESPONSE C.7.1: Comment noted.

RESPONSE C.7.2: A history of public involvement during preparation of the EIS, including a summary of the June 2, 1987 public hearing, is presented in Section 5 (Public Involvement) of the FEIS. Presentation of a history and summary of the many hearings that have been held on shell dredging is beyond the scope of these documents.

RESPONSE C.7.3: As discussed under Alternative 2 of Section 3.6.5.2, the immediate effects of unemployment resulting from permit denial would involve further expenditures of state unemployment benefits. To the extent that permit denial depleted state revenues, the base of state taxes would be adversely impacted.

RESPONSE C.7.4: Information has been added to Sections S.3.2 and 3.4.2.3.1 to address the concerns expressed in your comment.

RESPONSE C.7.5: See Response C.3.32.

RESPONSE C.7.6: Many questions remain unanswered about spent bauxite and gypsum waste. More studies and testing need to conducted when and if the need to use these "wastes" increases. Eventually, these "wastes" may be considered resources. Gypsum waste is a resource in Europe and Japan where it is used to make sulfuric acid.

RESPONSE C.7.7: Based on review of comments recieved on the DEIS, it is not clear whether or not the shell resources left in the sediments would be wasted. It is possible that the shells remaining in the sediments have an effect on the ultimate resuspensibility of the sediments, although it is acknowledged that the relative abundance of shells in the sediments today as compared with the volume that occurred historically has little effect on resuspension of sediments and turbidity.

RESPONSE C.7.8: The referenced numbers are correct.

RESPONSE C.7.9: The particular phrase referenced in this comment is relative, but may be somewhat misleading, and has been modified accordingly.

RESPONSE C.7.10: The thrust of this paragraph is that dredging creates a layer of fluid mud in areas adjacent to the actual dredge cut. Considering the rate of movement of the dredge along a curved path, the momentum of the propeller wash, the narrowness of the dredged trench, the dispersive effects of the propeller wash, the depths of the water, current speed, and the initial low density of the discharged slurry, it is believed that most of the deposited fluid mud material does not immediately return to the trench. It is also believed, however, that the trench created by the dredging activities does become gradually filled within a moderate time period due to hydrodynamic forces and the inherent instability of the bottom sediments in the lake (see pages C-94-95 of the FEIS).

RESPONSE C.7.11: Notwithstanding Dr. Taylor's stated failure to observe fluid mud, it is restated that the phenomenon occurs normally as the result of hydraulically-dredged sediments into open water (see Response C.7.4). The layer thickness would be small, however, and probably difficult to distinguish except very near the dredge path.

It is agreed that some of the Sikora's conclusions regarding bulk density changes in dredged sediment are not necessarily substantiated by their data. The tendency of the low-density layers of fluid mud to move horizontally along the lake bottom as well as vertically causes them to become rapidly dispersed over a much larger area than the underlying layers, and thus become thinner than would be observed in a laboratory settling column.

The extent to which this initial reaction to hydrodynamic forces and intermittent wave action influences the settling behavior and

consolidation rates of the moderate- and high-density layers differently than would occur in a settling column are unknown. It is nevertheless argued that their common exposure to those dynamic forces would be expected to cause the recently-dredged sediments to approach the bulk density levels of the adjacent undredged sediments considerably faster than the settling column experiments would indicate. This leads to the conclusion that the relatively low-density condition claimed by the Sikora's to be particularly harmful to Rangia and other benthic organisms would not be as persistent as their analysis indicated.

RESPONSE C.7.12: Comment acknowledged. Additional statistical information from NMFS has been added to the report.

RESPONSE C.7.13: The fact that croaker, spot, bay anchovy, and a variety of other estuarine organisms occur naturally in Lake Pontchartrain and other turbid estuaries in coastal Louisiana has been acknowledged in previous responses and in the EIS.

RESPONSE C.8.1: Comment noted.

RESPONSE C.9.1: The referenced statement that was extracted from the GSRI report is interpreted as meaning that, as a result of measurements of nearsurface turbidity plumes on several occasions, it was found that ambient turbidity levels had returned within a distance of about 1,000 feet. The report provides no specific information about the time periods of elevated turbidity levels, but acknowledged that variable wind and current conditions led to variability in the shapes and sizes of the observed plumes.

The statement was included in the EIS merely as a general indicator of the expected maximum extent of a surface turbidity plume, which is not to say that under certain hydrometeorological conditions a larger turbidity plume might not occur. The GSRI report also states that near-bottom turbidity plumes are somewhat more extensive than the surface plumes, which is borne out elsewhere in the EIS and in Appendix C.

RESPONSE C.9.2: This comment is incorrect. Mr. Carriere specifically asked Mr. Chew to explain, in detail, how Dr. Taylor conducted his diving operations to collect sediment core samples in Lake Pontchartrain when he conducted that sampling in September and November of 1986. Mr. Chew explained that he was not on either of the sampling trips and he personally did not know the details of the sampling at that time. Mr. Chew further stated that Mr. Goeke of the Corps staff did participate in that sampling and Mr. Goeke was asked to explain the sampling to Mr. Carriere.

The Corps is ultimately responsible for information presented in the EIS, regardless of whether information in the document is generated by the Corps, the applicant, consultants to the applicant, or any combination of the above. Information is not taken at face value.

RESPONSE C.9.3: The 1,000-foot figure for the short-term turbidity plume is merely used as an average and it is clearly acknowledged in the EIS and appendixes that the magnitude of the plume varies considerably depending on hydrometeorological conditions. Even if short-term

turbidity plumes do occasionally reach the grassbeds, it is highly unlikely that adverse impacts would occur. With regard to turbidity, it must be emphasized that the areas that historically supported and presently support most of the grassbeds are in the eastern portion of the lake where salinities are higher and the turbidity plumes are relatively short-lived. Even if the plumes reached these areas, it is highly unlikely they would persist long enough to harm grassbeds. The long-term increase in average lakewide turbidities is probably of far greater consequence with regard to impacts to grassbeds. It must be remembered that, in order to survive, any grassbeds that occupy the lake must be tolerant of the high levels of natural turbidity that often occur due to winds and riverine input. The same was true of the grassbeds that occurred historically, even before man-made perturbations affected the lake.

It is acknowledged that shell dredging creates a thin layer fluid mud in areas adjacent to the dredging activities, but this fluid mud does not last forever, and is by no means spread over nearly all of the open lake as stated in this comment.

Wind-driven currents have relatively little effect on the deeper portions of the water column, where the remnants of a turbidity plume would become concentrated at distance of 1,000 feet or greater. It is therefore very unreasonable to assume that wind currents would carry the plumes to nearshore grassbeds.

The analogy to the dust bowl is far-fetched. The assertion that fluid mud would travel miles from the dredge sites has absolutely no scientific basis. The restrictive forces on fluid mud movements along the lake bottom are orders of magnitude greater than those on dust particles in the air.

RESPONSE C.9.4: Reference is made to Comments and Responses B.5.9 through B.5.11 which refer to a field study conducted by Dr. Darnell on June 19, 1987. The detrital layer consisting of both dead plant material

of wetland origin and phytoplankton has been discussed in those comments and responses and address some of the concerns presented in this comment.

As stated in Comment B.5.11, Dr. Darnell noted that the blue-green algal layer is still present, but extremely thin. With regard with Darnell's reported decrease in dead plant material (Spartina), this is not unexpected since much of the wetland area around the lake has been lost.

It is acknowledged that many of the commercially harvested organisms utilize this detrital material during one or more stages of their life cycle. A statement regarding the importance of detritus to consumers in the lake, as reported in Darnell (1961), has been added to Section 3.5.2.2.1 of the EIS.

Although studies conducted since Darnell's study make no mention of a detrital layer or a living bottom algal mat, that does not mean that the layer has been absent since the early 1950's. Most of the studies in the lake were investigating other factors and may not have encountered or noted this bottom layer. The fact that Dr. Darnell noticed a thin layer of this material in his one day survey in June 1987 attests to the fact that it has not totally disappeared.

It is acknowledged that shell dredging harvest increased dramatically following Dr. Darnell's studies in the early 1950's. However, the "disappearance" of a detrital layer does not necessarily "coincide" with an increase in shell dredging. With regard to decreasing numbers of fish and shellfish in the lake, there are no data to support such a claim.

RESPONSE C.9.5: As noted in Response C.1.24, the estimate of bottom disturbance to which this comment refers includes only the area directly affected by passage of this fishmouth. Information has been added to the FEIS and the paragraph preceding the calculations in Appendix D to indicate that the calculations reflect only the area directly disturbed by passage of the fishmouth and that additional areas adjacent to the

actual dredge cut are affected by a thin layer of fluid mud, even though the DEIS and appendixes already discuss the area affected by fluid mud impacts in several areas.

If the term "disturbance" as used in this comment infers total annihilation of all organisms within a band of 401.24 meters, the calculations presented in this comment for the area "disturbed" by shell dredging dramatically overestimate area of "disturbance." Common sense dictates that such is not the case. If it were, no benthos would exist in mid-lake areas at all.

When the dredges operate, they do not move in a straight line, but in a circular pattern. They do not disturb a 400 meter wide swath and then move over and disturb another 400 meter wide swath. Rather, they move in a pattern of roughly concentric circles with overlapping zones of influence until shell recovery in the area decreases beyond the point of economic returns. Then the dredges move to another area. This is one factor that complicates the calculations. Another factor to consider is that the dredges operate according to zones and schedules established by the LDWF (see Response C.1.24) and the total area impacted over a given time period is limited by the area of that zone.

The figures for the area influenced by fluid mud and the thickness of the fluid mud used in the DEIS represented a very conservative estimate. However, as discussed under "Sediments - Physical Characteristics" in Appendix C of the FEIS, the New Orleans District requested assistance from the Waterways Experiment Station (WES) to provide more accurate information regarding fluid mud impacts. WES used their DIFCD open-water disposal model to perform computer simulations of shell dredging activities and it was determined that the fluid mud layer created by typical shell dredging activities would average about 0.5 to 0.8 inch over a 50-foot wide zone along each side of the dredge path. It was also estimated that the average thickness of the deposited sediments beyond 100 feet from the dredge path would be less than 0.1 inch after one hour. It is probable that many of the organisms in the area affected by

fluid mud are not killed. If they were, benthic populations in the lake would be in much worse condition than they are. As acknowledged by Mr. Chew, and in the EIS, fluid mud probably kills some organisms. However, it is very unreasonable to assume that the fate of the organisms in the area affected by fluid mud is as drastic as in the dredge cut itself. In fact, it is likely that some of the organsims even survive in the area directly dredged by the fishmouth.

RESPONSE C.9.6: This comment makes an issue about an observed difference of 4 NTU's between between pre-and post-dredged turbidity levels, and also about the bottom turbidity remaining at 30 NTU's six hours after the dredge has passed. Ten NTU's and 6 NTU's are very close readings. It is not unusual for turbidity readings to vary this much in samples taken only a few yards away from one another. These values are certainly well within the ranges of what is naturally experienced in Lake Pontchartrain without any known detrimental effects. Concerns regarding the small turbidity increases that remain after several hours have somehow been translated into various other forms of extreme biological, physical, and chemical changes. Impacts associated with elevated turbidities cited in this comment have been addressed in the EIS and appendixes. Comments regarding total time periods of days to months for turbidity to return to ambient conditions are totally without merit. With regard to the impacts of low salinity on turbidity levels, see Responses C.2.25 and C.3.17.

RESPONSE C.9.7: It is acknowledged that shell dredging may cause turbidity to exceed state water quality standards under certain conditions in certain portions of the lake and that periods of low salinity are more conducive to elevated turbidities, all other factors being equal. See Responses C.2.25 and C.3.17.

RESPONSE C.9.8: As with comment C.9.6, this comment attempts to build a case using incorrect assumptions: (1) A small 4 NTU residual turbidity increase over ambient 6 hours after dredging constitutes a significant impact; (2) The "significantly" higher turbidity does not diminish

further within 24, 48, or 72 hours; (3) The "significantly" higher turbidity is effective througout a 1000-foot wide distance along each side of the dredge path.

It has been observed in numerous monitoring investigations at dredging sites in Lake Pontchartrain and other large estuarine lakes and bays that turbidity plumes readily disperse and diffuse throughout the water column in the direction of the prevailing currents. In water bodies such as Lake Pontchartrain, having a small tidal range and relatively slow current speeds, the time required for virtually complete reversion to ambient turbidity levels is longer than in more dynamic systems, but has nevertheless been demonstrated to be no more than a few hours under most conditions.

RESPONSE C.9.9: The primary purpose of the Taylor re-study was to investigate recovery of the benthic communities at DC and DX over a longer period of time, not to study contaminants. Although Dr. Taylor did conduct some analyses of nutrients and heavy metals, information regarding these parameters was already contained in the DEIS at the time Dr. Taylor's report was recieved by the Corps and this information was not added. Information from Taylor's report used in the DEIS pertained only to the analyses of benthic organisms and recovery times.

In light of the concern regarding contaminants in these and other comments, the New Orleans District requested the assistance of contaminants experts from the Waterways Experiment Station (WES) in Vicksburg, Mississippi. Technical personnel at WES have conducted extensive research regarding contaminants and have worked with contaminant problems in many parts of the country. Much of the information used in responding to these comments is based on their guidance.

It is not clear what is meant by the term "critical levels" in the Taylor report unless it is referring to the proposed U.S. Geological

Survey "alert levels" which, in the case of cadmium, are 20 ppm in aquatic sediments. Section 4 of the summary of the Taylor report is based on four sediment cadmium values of 1.0, 0.32, <0.2, and <0.2 ppm; these values are well within the range of those reported for Lake Pontchartrain sediments (DEIS, TABLES C-8 through C-12) and in other coastal areas as reported by the Louisiana Department of Environmental Quality (DEQ) (1984) - Table 11.

The raw data for the PCB values reported by Sikora et al., (1981) on page 98 are not provided anywhere in the report and do not relate to the observations or data provided. In essence, the statements on page 98 appear to be anecdotal and cannot be evaluated because no data are provided. Because PCB's are ubiquitous contaminants in sediments from urban/industrial settings, the reported values of 0.32 $\pm$ 0.04 ug/g are not unusual or noteworthy, and that they are different from the Great Lakes values is not surprising. The fact that the difference is statistically significant does not imply any ecological significance. As noted in DEQ (1984), PCB levels in Pontchartrain organisms are an order of magnitude lower than FDA action levels and "indicate only minimal contamination." Because of low levels of PCB's in the sediment and the generally high organic content, this is as would be expected.

RESPONSE C.9.10: Concur. However, the results and conclusions were also extracted from the DEQ source document. "Metal concentrations in sediments were typically higher at nearshore stations located adjacent to the drainage canals. Sediment concentrations in the overall study area indicate a consistent spatial distribution with the highest levels adjacent to canal mouths and decreasing levels with increasing distance from these expected input sources." The text of the EIS has been changed to reflect trends which are supported by the data and our evaluation.

RESPONSE C.9.11: Contaminant levels of Lake Pontchartrain water and sediments are low, especially in areas away from the shoreline where shell dredging occurs. Because Lake Pontchartrain is a large, shallow

body of water, frequent resuspension of sediments from shell dredging, wind, vessel movement, shrimp trawling, tides, and storm events is common. Under such circumstances, organisms will reach an equilibrium with any contaminants which are present and bioavailable. The low levels of contaminants present, the lack of release during elutriate tests, and the low body burdens in organsims (DEQ, 1984) clearly indicates that neither shell dredging nor the other factors mentioned above result in significant bioconcentration or biomagnification.

RESPONSE C.9.12: As noted previously, the body burdens of contaminants in aquatic organisms in Lake Pontchartain are an order of magnitude lower than FDA action levels and do not pose a threat to human health. Levels in the avian species cited in the comment are unknown but must be remembered that these migratory species are exposed to numerous sources of contaminants over their range, including areas that are likely far more contaminated than Lake Pontchartrain.

The discussion of bioconcentration and bioaccumulation in the DEIS is taken from the lengthy document of Kay (1984) and, in light of the low levels of contaminants in the sediments, the organisms, and the lack of release of contaminants from the sediments during elutriate tests, is adequate.

RESPONSE C.9.13: We are not able to find any actual data in Sikora et al., (1981) regarding the relationship of fluid muds to bioaccumulation and/or bioconcentration of toxic metals and organic chemicals in Lake Pontchartrain. We do find an estimate that 15% of the time the entire lake bottom is in motion from natural causes (page 2), reference that the dredged material goes straight to the bottom with little plume formation (page 13), mention of a fluffy, organic-rich layer at the sediment-water interface (page 22), and the suggestion that additional research is needed to investigate suspended sediments in the near-bottom environment (page 22). Although Sikora et al., (1981) provide considerable speculation in the overview (pages 100-104) regarding the possible

formation of fluid mud, bioaccumulation, biomagnification, etc., as a result of shell dredging, they present essentially no data to support these hypotheses or to document that they constitute a problem in Lake Pontchartrain. Indeed, as is appropriate, they are careful to point out that any effects of dredging are difficult, if not impossible, to separate from the effects of natural events as well as other human activities.

RESPONSE C.9.14: Comment noted.

RESPONSE C.9.15: As noted previously, Tables C-8 through C-12 of the DEIS show no evidence of high concentrations of contaminants (we do not know what the term "critical" means) in Pontchartrain sediments.

It is not true that fluid muds resulting from shell dredging become widely distributed across the lake bottom even in areas distant from the dredging activity. The travel distance of fluid muds in Lake Pontchartrain is effectively limited by the weak tidal currents ($\pm$ 8 cm/sec). As the fluid mud becomes denser with time, it becomes increasingly resistant to lateral movement by the currents, until it becomes stationary.

Pages C-49 through C-82 of the DEIS are devoted almost exclusively to a discussion of physical effects (including fluid mud) of open-water discharges, including the findings of Sikora et al., (1981). It is correct that many chemicals adsorb to particulates; this process renders many of them relatively non-bioavailable. It is not correct that Sikora et al., (1981) found any relationship between fluid muds and bioconcentration in Lake Pontchartrain. As stated in the previous paragraph, fluid mud from dredging does not reach canal outfall areas, so dredging would not increase bioconcentration in those areas.

RESPONSE C.9.16: Bacterial contamination is generally a source of concern because of its impacts on primary contact recreation and shellfish harvest. Swimming in certain areas of Lake Pontchartrain is

discouraged, not due to shell dredging, but due to high bacterial counts from sewage and stormwater runoff. As discussed in Section 3.8.1 of the EIS, inordinately high bacterial densities impair primary contact recreation uses of the lake within the area extending from the shoreline to about 0.25 miles offshore in Jefferson and Orleans Parishes. A similar diminution of uses occurs at isolated locations along the north shore within about a 200-yard radius of where streams enter the lake. Generally, municipal wastewater discharges do not inhibit primary contact recreational uses of the more central portions of the lake, where shell dredging occurs. Lake Pontchartrain is closed to clam and oyster harvest, again due to high levels of bacterial input from adjacent urban areas. It should also be pointed out that bacteria, like most contaminants, tend to remain adsorbed to the sediment particles, and are not necessarily released during dredging activities.

The DEIS was reviewed by the Public Health Service, Centers for Disease Control in Atlanta, Georgia. They had no comments to offer (see Comment A.2.1).

RESPONSE C.9.17: The Corps coordinated with the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service regarding potential impacts to endangered species as a result of shell dredging. These agencies have jurisdiction over endangered species and are the acknowledged experts regarding these species. Based on correspondence with these agencies, the only endangered or threatened species potentially impacted by shell dredging in the lakes area are the Atlantic ridley and loggerhead sea turtles.

If the Endangered Species Office of the USFWS believed that shell dredging activities potentially harm bald eagles, peregrine falcons, or manatees, that office would have certainly notified us and we would have addressed any potential impacts in the Endangered Species Assessment and the EIS.

RESPONSE C.9.18: The fishmouth intake devices are not dredging progressively deeper. As stated in Section 1.3 of the DEIS, the fishmouth is either pushed or pulled through the upper 20-30 inches of sediments.

The analogy to terrestrial strip-mining is weak and in no way comparable to shell dredging in an aquatic environment. The issues cited in paragraph b. of this comment have been thoroughly addressed in the EIS and previous responses.

RESPONSE C.9.19: The trench that results from shell dredging in Lake Pontchartrain partially fills very shortly after dredging because some of the discharge material is directed back into the cut. In most areas, these trenches would fill completely in a moderate period of time due to the natural movement of bottom sediments. In addition, the bottom sediments are soft and the sides of the trench would tend to slope - they would not form vertical walls in most cases. The clams do not form cementious reefs as do oysters in the central coast area. Although we have heard numerous complaints about snagging of trawls in the coast area, where the troughs are deeper, we have received no other comment regarding this phenomenon in the lakes. Since the troughs are short-lived, snagging of trawls could be avoided by shrimping in zones where dredges are not operating.

As noted in the EIS and previous responses, there has been a documented change in abundance and frequency of occurrence of a few demersal fish species. However, there are no data to document the dramatic changes suggested in paragraph b. of this comment.

With the exception of scaup, nearly all of the ducks and other birds are found in the wetlands adjacent to the lakes or the shallow nearshore waters adjacent to the lakes. Impacts to duck hunting and birdwatching would be immeasurably small.

RESPONSE C.9.20: Section 3.6.1 discusses the long-range trends of the shell dredging industry because it is the economic activity most immediately and directly impacted by regulatory decision making. The EIS has included statistical data on commercial fishing in the lakes area because groups concerned with recreational and commercial fishing, shrimping, and crabbing have shown particular interest over the impacts of shell dredging. The most detailed information available on the harvest of fisheries in the lakes is from NMFS. The suspected values of unreported fishery harvest have also been discussed in the draft document and has been supplemented in the final report (see 3.6.1).

RESPONSE C.9.21: Information regarding the concerns expressed in paragraph a. of this comment have been added to the FEIS (see Section 3.7.8).

With regard to potential problems related to bacteria, see Response C.9.16.

As discussed in the documents and previous responses, there is no evidence to document a decline in seafood harvest in the lakes area (see Responses C.1.31 and C.2.2).

With regard to bioconcentration and bioaccumulation, refer to previous responses.

RESPONSE C.9.22: Most of the information upon which the DEIS was based is available for review in public, state, or university libraries. It is acknowledged that the GSRI (1974) and Taylor (1987) reports are not available in these libraries. However, this information is available for review at the New Orleans District and Mr. Carriere reviewed and copied portions of these documents at the District. We have received no other calls requesting the location of any of the materials used and cited in the documents.

RESPONSE C.9.23: It is acknowledged that bioaccumulation of certain toxic substances does occur and this is substantiated in the literature. However, based on a review of the literature regarding potential biomagnification of contaminants in marine and freshwater food webs, Kay (1984) reported the available data indicate it is not a dramatic phenomenon. Further, biological availability of contaminants from sediments should be similar regardless of whether or not the sediments have been dredged and placed in an open-water disposal site. In other words, the contaminants are not necessarily released from sediments during dredging and disposal operations. This has been documented by elutriate tests.

RESPONSE C.9.24: We concur that heavy metals and toxic organics can bioacccumulate in biota in aquatic ecosystems as a result of contaminants in the water column and sediments and that this is well documented in the literature. We also concur that additional studies will better define the mechanisms of biomagnification in aquatic ecosystems. However, as discussed in Responses C.9.9 through C.9.13, it does not appear that bioaccumulation of contaminants poses a serious threat in Lake Pontchartrain.

RESPONSE C.9.25: Concur. It is acknowledged that the literature contains numerous examples of uptake of PCB's by aquatic organisms, accumulation and biomagnification of organochlorine pesticides in aquatic food chains, and bioaccumulation of PAH's by certain aquatic species.

References 12 and 13 report, respectively, on the occurrence of volatile contaminants and base-neutral contaminants in oysters, clams, and sediments collected from the Inner Harbor Navigation Canal, Chef Menteur Pass, and the Rigolets, areas which are not subject to shell dredging. As would be expected, contamination was greatest in the canal and least at the Rigolets. The contaminants reported are ubiquitous in urban/industrial areas and are much lower than commonly found in major industrial areas, especially those with significant petrochemical

processing. The contaminants were shown, as elsewhere, to bioaccumulate. The significance of this to the organisms or in terms of human health are not known other than where there are FDA action levels and no action levels were approached. In that the areas studied are far removed from any shell dredging the reason for their inclusion is unclear. Reference 14 (from context we assumed reference 4 should have been 14) was a part of the same study as references 12 and 13 and addressed heavy metals rather than organics. We note the conclusion that "Comparisons of the levels of heavy metals in the biota and surface sediments of other Gulf Coast estuaries revealed similar concentrations (page 156). This further supports the findings that contaminants are not a problem with regard to the impacts of shell dredging. Further, references 12, 13, and 14 suffer from a major defect in that the organisms were not purged or depurated prior to analysis. This could result in pseudofeces, gut contents, or adherent particulate matter being erroneously reported as body burden contaminants.

RESPONSE C.9.26: Comment noted.

RESPONSE C.9.27: Comment noted.

RESPONSE C.9.28: There is no evidence that shell dredging, through the resuspension of contaminated sediments, is resulting in the elevation of contaminants in the aquatic biota of Lake Pontchartrain. Because the lake is a large shallow body of water, wind, tides, shrimp trawling, storm events, vessel traffic, and other factors as well as shell dredging act to resuspend sediment. When contaminants are present and bioavailable the organisms will reach an equilibrium with the contaminants. In the case of Lake Pontchartrain organisms, DEQ (1984) found that contaminants were at least an order of magnitude below FDA action levels.

RESPONSE C.10.1: The document projects remaining industry life based on estimates of known reserves and the most recent rates of production, about 3 million cubic yards annually. While simple extrapolation of production trends since 1975 would suggest a significant further decline in production could occur, it should be kept in mind that product demand during the second half of this 10-year period of record has been strongly influenced by the recent poor condition of both the oil industry and the economy of Louisiana, as well as completion of some major construction projects which used large volumes of the product. Some degree of general economic recovery will doubtless occur, and demand for shell, a basic building material, ought to share in that recovery. Paragraph 3.6.1.2 further makes it clear that the relatively short remaining life of the industry has been considered.

RESPONSE C.10.2: The DEIS acknowledges and gives consideration to the likelihood that adverse economic impacts which proposed alternatives might inflict on the industry could be partly offset by gains to producers of substitute goods. See paragraphs 3.6.1.2, 3.6.3.2, and 3.7.7.2.

RESPONSE C.10.3: The current use of clamshell ought to suggest that for at least those uses it is a superior, i.e., more efficient, product. Thus, any substitute good by definition could only partially offset the adverse impact of denying market access to the preferred product. The degree to which the use of alternative materials offsets adverse impacts on end-product cost and industry employment is a function of the substitutability, the cost, and the sources of the alternative material. A large portion of current shell use is in coastal road and oilfield construction, and in oyster reef maintenance. As is discussed in paragraphs 3.6.5.1 and 3.6.5.2, the performance and cost advantages of shell in these applications is so superior that one could expect significant impacts were shell not available. Other applications are not nearly as critical, although for many of these the use of alternative

materials carries with it negative impacts on local employment, etc., as discussed in paragraphs 2.2.3.2 and 3.6.3.2.

RESPONSE C.10.4: The dredges used by the industry are limited in number and pumping capacity by the Louisiana Department of Natural Resources and are currently all in use. In addition, dredging time is limited to about 18.5 hours per day due to maintenance, breakdowns, and inclement weather. Since the dredgers cannot increase the number or capacity of their equipment, and have no control over the weather, the only way that harvests could be substantially increased would be to improve the condition of their equipment, which is rather old and subject to frequent maintenance and breakdowns.

With regard to dredging deeper, the existing equipment does not permit dredging at significantly deeper depths. At deeper depths, the fishmouth becomes bogged down in the sediment and essentially functions as an anchor.

RESPONSE C.10.5: See response to Comment C.3.20.

RESPONSE C.10.6: See response to Comment C.3.20.

RESPONSE C.10.7: As noted in the comment, the mean of all observations is the generally preferred descriptive statistic. The duration values within these ranges, however, are a function of randomly occurring events (weather, breakdowns, etc.) as cited in the DEIS, so that over time the mean of all observations and the mid-point of the range could be expected to be about the same. In any event, the values shown are not particularly critical to the discussion; they are presented merely to illustrate the difference between currently permitted theoretical intensity and experienced actual intensity.

RESPONSE C.10.8: The DEIS discussion of reduced intensity has been expanded, but is not intended to be an exhaustive treatment of the

subject. It is intended to present reasonably expected economic and environmental outcomes of a range of output reduction modes in order to assess the value of further detailed consideration of such alternatives. As stated in the document, virtually no measurable positive environmental effects could be associated with the two methods considered of achieving a 25% reduction, while significant adverse socio-economic effects would result.

RESPONSE C.10.9: The DEIS discussion of reduced intensity, paragraph 2.2.3.2, has been expanded. See also response to comment C.10.1.

RESPONSE C.10.10: The DEIS discussion of reduced intensity, paragraph 2.2.3.2, has been expanded.

LITERATURE CITED

The following literature was cited in responding to comments.

Chatry, M., Dugas, C., and Gregory Laiche. 1986. Comparison of oyster setting rates on clamshell and crushed limestone. Louisiana Department of Wildlife and Fisheries. Technical Bulletin No. 40. pp. 54-60.

Darnell, R. M. 1961. Trophic spectrum of an estuarine community, based on studies of Lake Pontchartrain, Louisiana. Ecology 42(3): 553-568.

Darnell, R. M. 1962. Ecological history of Lake Pontchartrain, an estuarine community. American Midland Naturalist. 68(2): 434-444.

Dow, D. D. and R. E. Turner. 1980. Structure and function of phytoplankton in Lake Pontchartrain, Louisiana. Pages 321-428 in J.H. Stone, ed. Environmental Analysis of Lake Pontchartrain, Louisiana, its surrounding wetlands, and selected land uses. Prepared for U.S. Army Engineers District, New Orleans, Contract No. DACW29-77-C-0253.

Gulf South Research Institute (GSRI). 1974. Environmental impact of shell dredging in Lake Pontchartrain. Report GSRI Project No. 414-665-41. 275 pp.

Guillory, V. 1982. A comparison of fish populations in baseline and dredged areas in Lake Pontchartrain. Louisiana Dept. Wildl. Fish. Tech. Bull. No. 35: 63-67.

Hopkinson, C. S. and J. W. Day, Jr. 1979. Aquatic productivity and water quality at the upland-estuary interface in Barataria Basin, Louisiana. Proceedings of Conference on Ecological Processes in Coastal and Marine Systems. Tallahassee, Florida.

Kay, Stratford H. 1984. Potential for biomagnification of contaminants within marine and freshwater food webs. Department of the Army, Waterways Experiment Station, Vicksburg, MS. Technical Report D-84-7. 166 pp.

Louisiana Department of Environmental Quality. 1984. Report on interim findings-water quality investigation of environmental conditions in Lake Pontchartrain, April, 1984.

Mayer, M.S. 1986. The submerged aquatic vegetation of the Lake Pontchartrain estuarine system, Louisiana. M.S. Thesis. Univ. New Orleans, New Orleans. 100 pp.

Platt, T. and D. V. Subba Rao. 1973. Some current problems in marine phytoplankton productivity. Fish. Res. Bd. Canada Tech. Rpt. No. 370. 89 pp.

Riley, G. A. 1967. The plankton of estuaries. Pages 316-326 in G. H. Lauff (ed.) Estuaries. Publ. No. 83. A.A.A.S., Washington, D.C.

Roberts, P.W. 1981. Structure and function of nearshore and open lake benthic communities in Lake Pontchartrain, Louisiana. M.S. Thesis, Louisiana State University, Dept. of Marine Sciences. 50 pp.

Roberts, K. G. and M. E. Thompson. 1982. Economic elements of commercial crabbing in Lake Pontchartrain and Lake Borgne. Ctr. Wetland Resources, Sea Grant Publ. No. LSU-TL-82-001. Louisiana State University, Baton Rouge. 9 pp.

Sikora, W. B. and J. P. Sikora. 1982. Ecological characterization of the benthic community of Lake Pontchartrain, Louisiana. Publ. No. LSU-CEL-82-05. U.S. Army Corps of Engineers, New Orleans District. Contract Rep. No. DACW29-79-C-0099.

Sikora, W. B., Sikora, J. P., and A. McK. Prior. 1981. Environmental effects of hydraulic dredging for clam shells in Lake Pontchartrain, Louisiana. Publ. No. LSU-CEL-81-18. U.S. Army Corps of Engineers, New Orleans District. Contract Rep. No. DACW29-79-C-0099. 140 pp.

Stone, James H. and Linda Deegan. 1980. Preliminary modeling of the Lake Pontchartrain ecosystem by computer simulations. Pages 1-20 in J.H. Stone, ed. Environmental Analysis of Lake Pontchartrain, Louisiana, its surrounding wetlands, and selected land uses. Vol. 1 CEL, CWR, LSU, BR, LA 70803. Prepared for U.S. Army Engineers District, New Orleans. Contract No. DACW29-77-C-0253.

Stone, James H., Day, J. W., Bahr, L. M., and R. E. Turner. 1980. Executive Summary: An emerging view of the Lake Pontchartrain ecosystem. Pages xxii-xxxii in J.H. Stone, ed. Environmental Analysis of Lake Pontchartrain, Louisiana, its surrounding wetlands, and selected land uses. Vol. 1 CEL, CWR, LSU, BR, LA 70803. Prepared for U.S. Army Engineers District, New Orleans. Contract No. DACW29-77-C-0253.

Taylor, J. L. 1987. Shell dredging reevaluation and sediment study-Lake Pontchartrain, Louisiana. 225 pp.

Thompson, B. A. and G. R. Fitzhugh. 1985. Synthesis and analysis of Lake Pontchartrain environments, influencing factors and trends. CFI, CWR, LSU, BR, LA 70803-7503. Prepared for Louisiana Department of Environmental Quality, Office of Water Resources. 238 pp.

Thompson, B. A. and J. S. Verret. 1980. Nekton of Lake Pontchartrain, Louisiana, and its surrounding wetlands. Pages 711-863 in J.H. Stone, ed. Environmental Analysis of Lake Pontchartrain, Louisiana, its surrounding wetlands, and selected land uses. Vol. 1 CEL, CWR, LSU, BR, LA 70803. Prepared for U.S. Army Engineers District, New Orleans. Contract No. DACW29-77-C-0253.

Turner, R. E., Darnell, R. M., and J. R. Bond. 1980. Changes in the submerged macrophytes of Lake Pontchartrain, Louisiana: 1953-1974. Pages 647-657 in J.H. Stone, ed. Environmental Analysis of Lake Pontchartrain, Louisiana, its surrounding wetlands, and selected land uses. Vol. 1 CEL, CWR, LSU, BR, LA 70803. Prepared for U.S. Army Engineers District, New Orleans. Contract No. DACW29-77-C-0253.

Witzig, A. S. and John W. Day, Jr. 1980. A trophic state analysis of Lake Pontchartrain and surrounding tributaries. Pages 21-36 in J.H. Stone, ed. Environmental Analysis of Lake Pontchartrain, Louisiana, its surrounding wetlands, and selected land uses. Vol. 1 CEL, CWR, LSU, BR, LA 70803. Prepared for U.S. Army Engineers District, New Orleans. Contract No. DACW29-77-C-0253.

U. S. Department of Commerce, Bureau of the Census, Statistical Abstract of the United States, 1987, 107th Edition. Washington D.C., 1986.

U. S. Fish and Wildlife Service. 1984. Mississippi and Louisiana Estuarine Areas Study, Fish and Wildlife Coordination Act Report. 41 pp.

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